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A METHOD FOR DETERMINING THE EXTENT OF POLYMERIZATION OF ACRYLIC RESINS AND ITS APPLICATIONS FOR DENTURES

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Acrylic resin has been used by the dental profession for several years. In this resin and its copolymers dentists have potentially some of their best prosthetic materials. In spite of their excellence, many difficulties have been reported, among them water absorption, dimensional instability, brittleness, discoloration, difficulty of repair and bubble formation. These difficulties for the most part are not inherent properties of acrylic resin but are defects induced in it by improper processing.

Acrylic resin is supplied for dental use in two forms. In one, a powder (polymer) and a liquid (monomer) are furnished and mixed at the time of processing, and in the other, the material is sold as a gel, the mixing of the polymer and the monomer having been done by the manufacturer. The mechanism of polymerization (curing) in both is identical. The liquid (monomer) contains a double bond in each molecule, which is capable of reacting with any similar molecule also containing a double bond to form a chain of monomer units, with loss of one double bond each time two units join. This chain formation, or polymerization, is the process by which the plastic mixture of powder and liquid is converted into a solid.

It is believed that variations in physical properties and some of the other difficulties observed in acrylic dentures are associated with the nature and completeness of polymerization and the possible retention of monomer. Any improvement, therefore, in the resin as a denture material will be derived from increased knowledge and the application of elements which influence polymerization.

A chemical method for determining the degree of polymerization has been developed, and has been used to show that

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the variations in physical properties are related to the degree of polymerization, which is affected by time, temperature and pressure, as well as by the presence of impurities. The method is applicable to the investigation of irregularly shaped specimens, which cannot be studied by the usual physical methods.

It is the purpose of this paper to describe this chemical method and its application to some dental problems encountered in curing acrylic dentures.

Method

Wijs[1] demonstrated that a solution of iodine monochloride reacts with double bonds of some unsaturated organic compounds. Experiments performed at the National Bureau of Standards have shown that this solution may be used to determine the number of double bonds in solutions of monomer or polymerized acrylic resin. The term "acrylic resin" refers to the family of acrylic ester resins used for making dentures. Methyl methacrylate is a member of this family. In these experiments weighed samples of methyl methacrylate of not more than 5 Gm. polymer or 90 mg. monomer were dissolved in 40 ml. chloroform in glass stoppered 300 ml. Erlenmeyer flasks. Twenty milliliters of approximately 0.2 normal Wijs solution[2] (iodine monochloride) was transferred with a pipet into each flask. The stoppered flasks were placed in the dark at room temperature for 16 to 24 hours, after which the excess Wijs solution was determined by titration with tenth-normal standard sodium thiosulfate solution in the following manner:

One hundred milliliters of a freshly prepared 10 per cent potassium iodide solution[3] is added to the reacted solution to be tested. Iodine is liberated in accordance with the following reaction:

$$KI + ICl \rightarrow KCl + I_2$$

The mixture of the two solutions separates into two dark reddish brown layers, an aqueous layer on top and a chloroform layer on the bottom. Tenth-normal standard thiosulfate is added from a buret while the flask is constantly swirled until the top, or aqueous, layer becomes colorless and the chloroform layer pink. At this time sufficient thiosulfate has been added to react with most of the iodine. Five milliliters of a starch solution[4] is added, and if the aqueous layer turns dark, thiosulfate is added dropwise while the flask is swirled until the top layer again becomes colorless. The flask is then stoppered and shaken vigorously in order to extract the remaining iodine from the chloroform layer. The aqueous layer again takes on color. Thiosulfate is again added dropwise while the flask is swirled or shaken, until 1 drop of thiosulfate solution makes both layers colorless when the monomer is being titrated. With the polymer, however, the tendency is for the chloroform layer to become white and opaque. The aqueous layer also becomes white, but the color is not nearly so dense. The thiosulfate solution is added until there is no change in color. Titrations containing either polymer or monomer usually become colored again after standing a few minutes. The end point is considered to have been reached when there is no return of color for at least one minute.

Blanks containing volumes of chloroform and Wijs solution equal to those in the samples are tested along with the samples. Both samples and blanks are determined in duplicate. The quantity of Wijs solution (iodine monochloride) absorbed by the resin sample is obtained by

1. Wijs, J. J. A., Zur Jod-Additionsmethode. *Ber. d. deutsch. chem. Gesellsch.* 31:750, 1898.

2. All the reagents used except the potassium iodide solution were prepared according to the federal specification for varnish and shellac, No. TT-V-91a (Washington: U. S. Government Printing Office).

3. Potassium iodide free from iodate, 100 Gm., dissolved in distilled water and diluted to make 1 liter. Fresh solution must be employed, since iodide solutions are readily oxidized on standing to form free iodine.

4. Soluble starch, 5 Gm., dissolved in 500 ml. hot water containing 1 Gm. salicylic acid.

correcting the titer for the quantity used by the blank. This corrected quantity of Wijs solution is used to calculate the number average molecular weight, which is an indication of the number of double bonds in the monomer or polymer sample.

Assuming that each molecule contains one double bond, the number of double bonds or molecules present is a measure of the degree of polymerization. For the purpose of this discussion the degree of polymerization has been expressed as the number average molecular weight (M_n), which is an average in which each molecule, whether polymer or monomer, carries the same weight in the resulting average. It is an excellent measure of the completeness of polymerization. This value may be calculated from the quantity of tenth-normal Wijs solution which reacts with the methyl methacrylate sample and the weight of the sample in milligrams.

$$M_n = \frac{W}{n} \qquad (1)$$

where W = milligrams of sample
n = millimols of polymer or monomer

$$\text{but} \qquad n = \frac{5.1V}{100.1} = 0.051V \qquad (2)$$

where V = milliliters of tenth-normal Wijs solution absorbed by the reaction
0.051 = millimols of monomer or polymer per milliliter of tenth-normal Wijs solution
5.1 = milligrams of monomer per milliliter of Wijs solution (Fig. 1)
100.1 = molecular weight of methyl methacrylate monomer

Substituting the value of n in equation 1 gives

$$M_n = \frac{W}{0.051V} \qquad (3)$$

Since W and V are measured quantities, a value of M_n may be obtained.

The value for the number average molecular weight obtained by this method would be affected by the presence in the resin of plasticizers, fillers and resins other than acrylic. These additions would give a false value for the number average molecular weight. However, this does not interfere with the usefulness of the method for investigating the factors which effect polymerization for any one brand of resin.

Mixtures of polymer and monomer were made, and the number average molecular weights were determined and also calculated (Table 1). The number average molecular weight may be defined as

$$M_n = \frac{\Sigma n_i M_i}{\Sigma n_i} = \frac{1}{\Sigma f_i / M_i},$$

where n_i is the number of molecules of M_i, and f_i is the weight fraction of these molecules.

This fraction may be reduced to

$$M_n = \frac{1}{\frac{f_p}{M_p} + \frac{f_m}{M_m}} \qquad (4)$$

for Table 1, in which it is assumed that all the polymer has a molecular weight (M_p) of 22400, and the molecular weight of the monomer (M_m) is 100. The symbols f_p and f_m designate weight fractions of polymer and monomer.

From Table 1 it can be seen that if 0.9 per cent of residual monomer was in a sample of resin having an original number average molecular weight of 22400, the resultant resin had a number average molecular weight of about 7300.

The number average molecular weights of ten brands of acrylic resin powder and of specimens polymerized from these powders in accordance with the manufacturers' recommendations were determined (Table 2). The number average molecular weights of the polymeric powders prior to curing varied between 3500 and 36000. These same products after curing had number average molecular weights from 8000 to 39000. In all but one product, the molecular weight increased on curing. It is not known at the present time how the wide variation

Table 1.—Lowering of the number average molecular weight (M_n) of methyl methacrylate by additions of small quantities of monomer

Monomer, mg.	Polymer, mg.	Monomer, per cent	0.1 N Wijs solution absorbed, ml.	M_n (equation 3)	M_n (equation 4)
0.0	535	0.00	0.47	22400	——
4.7	535	0.87	1.45	7300	7600
14.2	535	2.59	3.28	3300	3300
37.8	535	6.60	8.00	1400	1400

in number average molecular weight in both the powder and the cured resin affects the chemical and physical properties of a denture prepared from the material.

Comment

Preparation of Sample.—Inhibitor.—The acrylic resin used by the dental profession is usually purchased in the "powder-liquid" form. The liquid contains an inhibitor, usually hydroquinone, to prevent polymerization at room temperature.

In order that the effect of the inhibitor on the Wijs reaction might be determined, 5 ml. portions of inhibited monomer were placed in flasks and evaporated to dryness with a gentle stream of air blown into the flask. Then chloroform was added, followed by Wijs solution. The solution was titrated. None of the Wijs solution was used by the residue from the inhibited monomer. Therefore, the inhibitor, either because a small quantity was present or because it did not react with the Wijs solution, had no effect on the reaction.

Size of sample.—The quantity of 0.2 normal Wijs solution to be added to the chloroform solution of monomer or resin for consistent results was determined by a series of experiments with various quantities (4 to 142 mg.) of purified monomer[5] dissolved in chloroform solution.

Ten, 20 and 40 ml. of 0.2 normal Wijs solution were added to the chloroform solutions. Titrations with thiosulfate neutralized the excess Wijs solution, as previously described. The excess Wijs solution, subtracted from the amount added, which had been corrected for the blank, gave the amount of Wijs solution absorbed. Values have been plotted in Figure 1 as tenth-normal Wijs solution absorbed. A plot of the various quantities of monomer and the volume of Wijs solution absorbed by each quantity must

Table 2.—Number average molecular weight of several specimens of acrylic resin before and after being cured

Sample	Powder	Cured specimen*
A	3500	10000
B	7000	8000
C	22000	36000
D	11500	9000
E	29000	32000
F	23000	35000
G	31000	36000
H	27000	32000
I	36000	39000
J	11000	17000

* Cured according to the recommendations of the manufacturers.

5. Inhibitor-free monomer was prepared for these experiments by distillation of the inhibited monomer at pressure of 9 to 10 cm. mercury. The middle fraction was used for the sample. Five milliliters of the middle fraction was pipetted into chloroform and diluted to make 1 liter. This solution was stored in a refrigerator to avoid any possibility of polymerization.

result in a straight line if the reaction goes to completion. The addition of 10 ml. of 0.2 normal Wijs solution was insufficient to complete reactions in which less than 50 per cent of the added solution was absorbed (Fig. 1).

Twenty milliliters of 0.2 normal Wijs solution is sufficient to react completely with 90 mg. or less of methyl methacrylate monomer. The weight of polymer must be adjusted so that the quantity of 0.2 normal Wijs solution absorbed in the reaction will always be less than 8½ ml. when 20 ml. of 0.2 normal Wijs solution is added.

In Figure 1, curve 20, 51 mg. of monomer is shown to absorb 10 ml. of tenth-normal Wijs solution, or 1 milliequivalent of Wijs solution. Since the molecular weight of methyl methacrylate is 100.1, the equivalent weight for this reaction would be 50.05. The discrepancy between the value of 50.05 and the graph value of 51 may indicate one or more of three things: (1) that the values agree within the experimental error of the method, (2) that the reaction is not complete or (3) that the methyl methacrylate monomer used was not pure.

Errors in Determination.—In equation 3,

$$M_n = \frac{W}{0.051\ V},$$

two important facts may be found: 1. When the errors are not large, the percentage of error in number average molecular weight is approximately equal to the percentage of error in the volume of Wijs solution absorbed by the reaction if the errors in the weight of sample and the factor 0.051 can be neglected. 2. The volume of Wijs solution absorbed is proportional to the weight of the sample of resin.

Thus, if the number average molecular weight of a sample of methyl methacrylate resin is determined, the error involved will be dependent on the volume of Wijs solution absorbed, and the volume of Wijs solution absorbed will vary with the size of sample used. If an error of ±0.1 ml. is assumed for the volume of Wijs solution absorbed because of titration errors, it is possible to calculate the error in number average molecular weight. For example, 400 mg. of 19600-molecular-weight methyl methacrylate resin absorbs 0.4 ml. of tenth-normal Wijs solution. In this case the volume of Wijs solution would be 0.4±0.1 ml. Then the number average molecular weight would be $19600\ ^{+6500}_{-3900}$, or an error of 20 to 33 per cent. If the size of sample is increased tenfold, to 4,000 mg., the Wijs solution absorbed would be 4.0±0.1 ml. Then the number average molecular weight would equal 19600±500, or an error of about 2½ per cent. By the use of this method the error in number average molecular weight can be calculated and the size of sample adjusted to decrease the error.

At the present time it has been found somewhat impractical to use samples weighing more than 5 Gm. in 40 ml. of chloroform. This is due primarily to the viscous character of solutions containing larger percentages of polymer. Difficulties of titration are encountered, and the results become less accurate. The use of larger volumes of chloroform solution should overcome this difficulty.

Time and Temperature.—The minimum time for the reaction between monomer and iodine monochloride to reach completion was determined by a set of experiments in which the reaction solutions of monomer and iodine monochloride were allowed to react for definite periods up to 72 hours. After 16 hours the reaction appeared to be complete, because the quantity of iodine monochloride absorbed by the monomer solution was practically constant after this time. Figure 2 shows the results of this set of experiments during the first 24 hours of reaction. The reaction time used was based on these results.

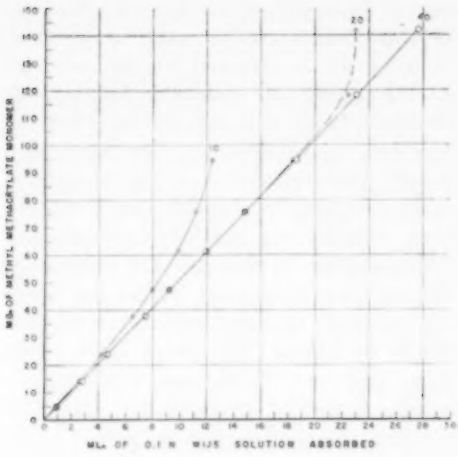

Fig. 1.—Relation of amount of Wijs solution consumed to the quantity of monomer present. The numerals 10, 20 and 40 on the curves indicate that 10, 20 and 40 ml. of 0.2 normal Wijs solution were added to the solutions of monomer. The quantities of Wijs solution used by the monomer were calculated to tenth-normal because the volumes in the titrations were read as volumes of approximately tenth-normal standard sodium thiosulfate solution and corrected to 0.1000 normal

Because the temperature at which a chemical reaction occurs often has an important effect on the completeness of the reaction, another group of experiments was performed to determine the effect of temperature. One series of reactions was kept at a temperature of 33 C. (91.4 F.) and a second series at 8 C. (46.4 F.). No differences in the quantity of Wijs solution absorbed by the monomer solution were observed.

Potassium Iodide Solution.—A large quantity (100 ml.) of 10 per cent aqueous potassium iodide solution was used for several reasons:

1. Potassium iodide reacts with the chlorine present in the excess Wijs solution to form iodine:

$$KI + ICl \rightarrow KCl + I_2$$

This in turn is titrated with the thiosulfate solution.

2. The high percentage of potassium iodide makes the free iodine more soluble in the aqueous layer, so that less iodine is retained by the chloroform layer. The actual titration becomes easier as the end point is approached before the addition of the starch solution.

3. The large quantity of potassium iodide prevents volatilization of iodine.

Applications

Polymerization of acrylic resins is an exothermic reaction, one that produces heat. Studies by the National Bureau of Standards and other laboratories showed that during curing the thick ridge sections of dentures reached temperatures as high as 140C. (284F.), while in the thin palatal regions temperatures seldom were above 110C. (230F.). Where lower temperatures exist, the speed of reaction is less, and polymerization is likely to be incomplete. Where higher temperatures result, the speed of the reaction is greater, and polymerization is more nearly complete.

The method has been used to investigate the effects of curing temperature, thickness, additional cure (repair) and impurity of specimens.

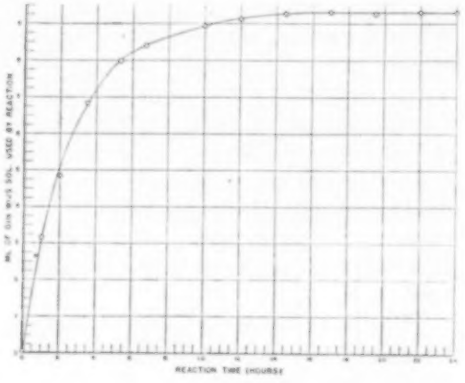

Fig. 2.—Effect of time on the completeness of reaction of Wijs solution and monomer

Curing Temperature.—Experiments were made in which samples of "powder-liquid" resin were cured by two different technics. One sample was cured by immersion of the flask in a water bath at 75C. (167F.) for two and a half hours. The flask containing the other sample was placed in water at room temperature, gradually warmed to 100C. (212F.) in one and a half hours and kept at this temperature for 45 minutes.

Transverse strength tests were made of specimens cut from the cakes of resin prepared by these methods. The specimens that received the boiling water cure were stronger and stiffer than the specimens cured at 75C. (167F.) (Fig. 3). The number average molecular weights were determined on the broken specimens. For the specimen cured in boiling water, the value was 35000; for the specimen cured at 75C. (167F.), the value was 5600.

Thickness.—Harman[6] observed that specimens cut from different sections of denture have different physical properties. Specimens from the thin, or palatal, regions are weaker, softer and dimensionally less stable than specimens from the thicker, or ridge, regions of the same denture.

In a series of experiments a specimen having thick and thin sections similar to those in a denture was cured in a water bath at 75C. (167F.) for two and a half hours. The dimensions of the thin section were 48 by 54 by 2 mm., and those of the thick section were 48 by 12 by 14 mm. Thermocouples were placed in the two sections of the specimen. The highest temperature obtained in the thin section was 79C. (174F.), and in the thick section, 112C. (234F.). Number average molecular weights were found to be 6000 for the thin section and 25000 for the thick. These data indicate that the thick section will be stronger than the thin section because of the more complete cure which occurred in the thick section, where the higher temperature was observed. The thin section, because of low molecular weight material or residual monomer, will be weaker. Further evidence of the same nature was obtained by Beall and Caul,[7] who reported that the introduction of a small amount of solvent into fully polymerized acrylic resin lowers the transverse strength and hardness. This explains the observations made by Harman[6] that specimens made from thin sections are weaker than specimens cut from thick sections.

Additional Cure (Repair).—There is some possibility that difficulties in repairing dentures may occur from further polymerization during recuring. Two specimens were prepared for investigation of this possibility. One was cured at 75C. (167F.) for two and a half hours and the other in boiling water for 45 minutes after a preliminary heating from room temperature to the boiling point in one and a half hours. A portion of each specimen was reserved for determinations of number average molecular weight, and the remainder was recured twice by being "flasked" and placed in boiling water each time for one hour. The number average molecular weight of the specimen cured at 75C. (167F.) increased from 5400 to 29000 when the specimen was recured at 100C. (212F.). The number average molecular weight of the specimen initially cured in boiling water did not change when it was recured in boiling water. The value remained at 29000.

One would expect that specimens prepared from the resin cured at 75C. (167F.) would be dimensionally less stable, since shrinkage invariably accompanies further polymerization. This may account for part of the shrinkage which

6. Harman, J. M., Effects of Time and Temperature on Polymerization of a Methacrylate Resin Denture Base. *J.A.D.A.* 38:188 (Feb.) 1949.

7. Beall, J. R., and Caul, H. J., "Liners" for Dentures. *J.A.D.A.* 33:304 (March 1) 1946.

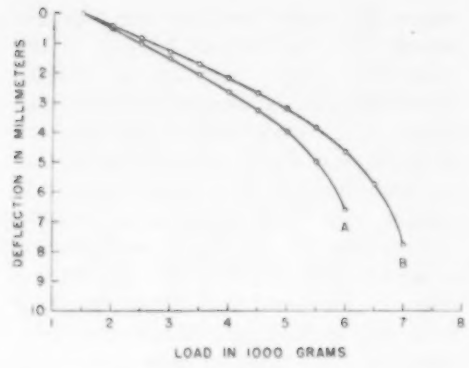

Fig. 3.—Effect of different curing temperatures on the transverse strength of acrylic resin. Curve A, average of four specimens cured at 75 C. (167 F.) for two and a half hours; curve B, average of four specimens cured by being heated from room temperature to 100 C. (212 F.) in one and a half hours and held at 100 C. for 45 minutes

has been observed on repair, particularly if the palatal, or thin, sections of the denture are incompletely polymerized during the initial cure of the denture.

Impurities.—Data obtained at the National Bureau of Standards show that the addition of small quantities of impurities, known to affect polymerization, definitely changed the physical properties of the resin cured by a standard dental technic.

Ferguson, Paffenbarger and Schoonover[8] observed that clear resins cured against some brands of rubber dam turn red and that the transverse strengths of specimens cut from these resins are lower than the values obtained from specimens cured against tinfoil. Determinations of the number average molecular weight of these specimens were made. A value of 14000 was found for the specimens cured against the rubber dam, and a value of 30000 was obtained for the specimens cured against tinfoil. The effect on transverse strength is shown in Figure 4. The decrease in number average molecular weight when the rubber dam was used has been traced to the presence of some material in the rubber which was dissolved by the monomer and was the cause of the retarded polymerization.

The effect of another impurity on the process of polymerization was illustrated further by a series of experiments in which sulfur was intentionally added to the resin prior to curing. Six rods (6 mm. in diameter and 50 mm. long) were prepared and cured in the same flask with the same brand of powder and liquid. Three of the rods were intentionally contaminated by using monomer saturated with sulfur. After being cured, the specimens without sulfur were normal, but the ones containing sulfur were rubbery. Number average molecular weights were 1400 for sample containing sulfur and 17000 for samples without sulfur. These results indicate that a small amount of sulfur has a decided inhibiting action on this type of polymerization.

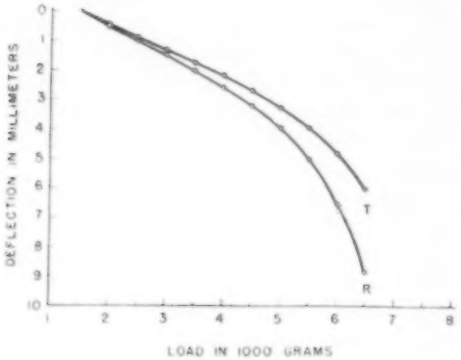

Fig. 4.—Effect of curing against some brands of rubber dam and tinfoil on the transverse strength of acrylic resin. Curve R, average of five specimens cured against rubber dam; curve T, average of five specimens cured against tinfoil in same manner as in R

Summary

A chemical method has been developed to determine the completeness of poly-

8. Ferguson, G. W.; Paffenbarger, G. C., and Schoonover, I. C., Deficiencies of Tinfoil Substitutes in the Processing of Acrylic Resin. *J.A.D.A.* 38:573 (May) 1949.

merization of cured acrylic resin. The method is based on a determination of number average molecular weight or of the number of double bonds.

Number average molecular weight may be used to correlate some of the chemical and physical properties with conditions of cure (time, temperature and presence of impurities).

The method is applicable to the investigation of irregularly shaped specimens which cannot be tested by conventional methods, and is useful in evaluating the uniformity of a manufacturer's product.

Data have been obtained which indicate that the lower transverse strength of thin sections of dentures as compared with thick sections is the result of less complete polymerization in the thin sections.

The low transverse strength of specimens cured at 75C. (167F.) for two and a half hours appears to be the result of incomplete polymerization. Specimens polymerized at 100C. (212F.) for 45 minutes are stronger.

Impurities introduced into resins processed against some brands of rubber dam prevent complete curing of the resin.

The number average molecular weights of several different brands of acrylic powder prior to curing vary between 3500 and 36000; after curing in accordance with the manufacturer's recommendations, they vary from 8000 to 39000.

THE EVOLVEMENT OF OPHTHALMOPROSTHESIS TO CIVILIAN REQUIREMENTS

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THE science of eye replacement has its derivation from China, where jade was inserted over the sunken eyeballs of the deceased more than two thousand years ago.[1] In a replica of the bust of Caligula, third emperor of Rome, about 53 B.C., anatomic prostheses were made to replace the original of ivory and glass.[2]

Paramount among the advances in medicine resulting from World War II are plastic, maxillofacial and rehabilitation surgery.[3] These words are from an

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1. Chan, Eugene, Personal correspondence, E.E.N.T. Hospital, United Hospitals, W. China Union University, Changtu Sze, China.

2. Bruce, G. M., Ancient Origins of Artificial Eyes. *Ann. M. Hist.* 2:10 (Jan.) 1940.

3. Zieman, Stephen, Acrylic Ocular Prosthesis. (Editorial) *U. S. Navy Med. Bull.* 43:1258 (Dec.) 1944.

editorial about the article[4] describing the original research on eye replacement which has been further evolved in civilian life. From this evolvement a new profession has been born which has been termed ophthalmoprosthesis.

The salient objective of this article is to give a clear, concise and brief research report of the refinements in clinical technic that have substantiated the original research[4] and proved its practical value over the past five years. Creation of this original technic was essential to accomplish all the desired objectives.

This technic has been used on a significant number of patients, with consistently satisfactory results. Almost every case varies in the problem presented, and shows the wide range of usefulness the basic technic gives.

Eye loss has necessitated ocular restoration in patients who have varied in age from 5 months to old age. The use of this technic in eye restoration for children is especially valuable. Results of ocular replacement obtained with children portray the restoration of previous appearance, which brings about the child's acceptance by his playmates and school associates. The fact that the prosthesis cannot easily be dislodged in sports, and does not break easily, causes the young boy or girl to be unconscious of the handicap.

A description of the technic with the important steps photographically shown, portrays the reconstruction of the right eye region by the method now in use.

An Anatomic Evaluation

In the illustration of the natural eye (Fig. 1, *A*), the contour of the lids is seen to conform to the anatomic structure of the orbit. When the eye is removed or eviscerated, the lids collapse to produce a characteristic depression (Fig. 1,*B*). The upper lid is depressed due to contraction of the intact palpebral muscle to which it is attached. The lower lid is depressed to a lesser degree depending on the amount of tissue which was removed at the time of evisceration.

Patients have previously employed the type of prosthesis (Fig. 1,*C*) which was not custom made, but selected from a tray of replacements to fit as nearly as possible under the circumstances. As a result the upper lid usually was not restored (Fig. 1,*D*) to its former facial contours. This occurs because the prosthesis only attempts to form a window for the eyelids. The upper lid continues to be sunken or in many cases appears to lack muscle tone. This often produces a drooping lower lid which exaggerates the lid opening at the lateral canthus.

The external appearance of the orbital region (Fig. 1,*E*) is quite disheartening especially from the profile view, which presents an unnatural sunken area. As a result there is a distinct contrast with the normal side to the extent that the sunken area of the patient's face appears several years older. From the front view (Fig. 1,*F*) the upper lid is collapsed because the restoration fails to replace adequately the space occupied by the natural eye. The greater lid, consequently, slides along the curved surface of the prosthesis.

The Successful Replacement

To provide a successful replacement, it is necessary that the remaining muscle tissue be taken into consideration. Since no two sockets are the same, an artificial eye must be custom made to fit the socket of the individual. First, photographs are made of the area to be restored. They show the extent of the collapsed area, and the contours of the face which are to be rebuilt.

In order to insure actual size reproduction of the iris, the diameter of the existing iris is compared with the diameter of its image on the ground glass of the

4. Murphey, P. J., and Schlossberg, L., Eye Replacement by Acrylic Maxillofacial Prosthesis. *U. S. Navy Med. Bull.* 43:1085 (Dec.) 1944: *Mil. Surgeon* 96:469 (June) 1945.

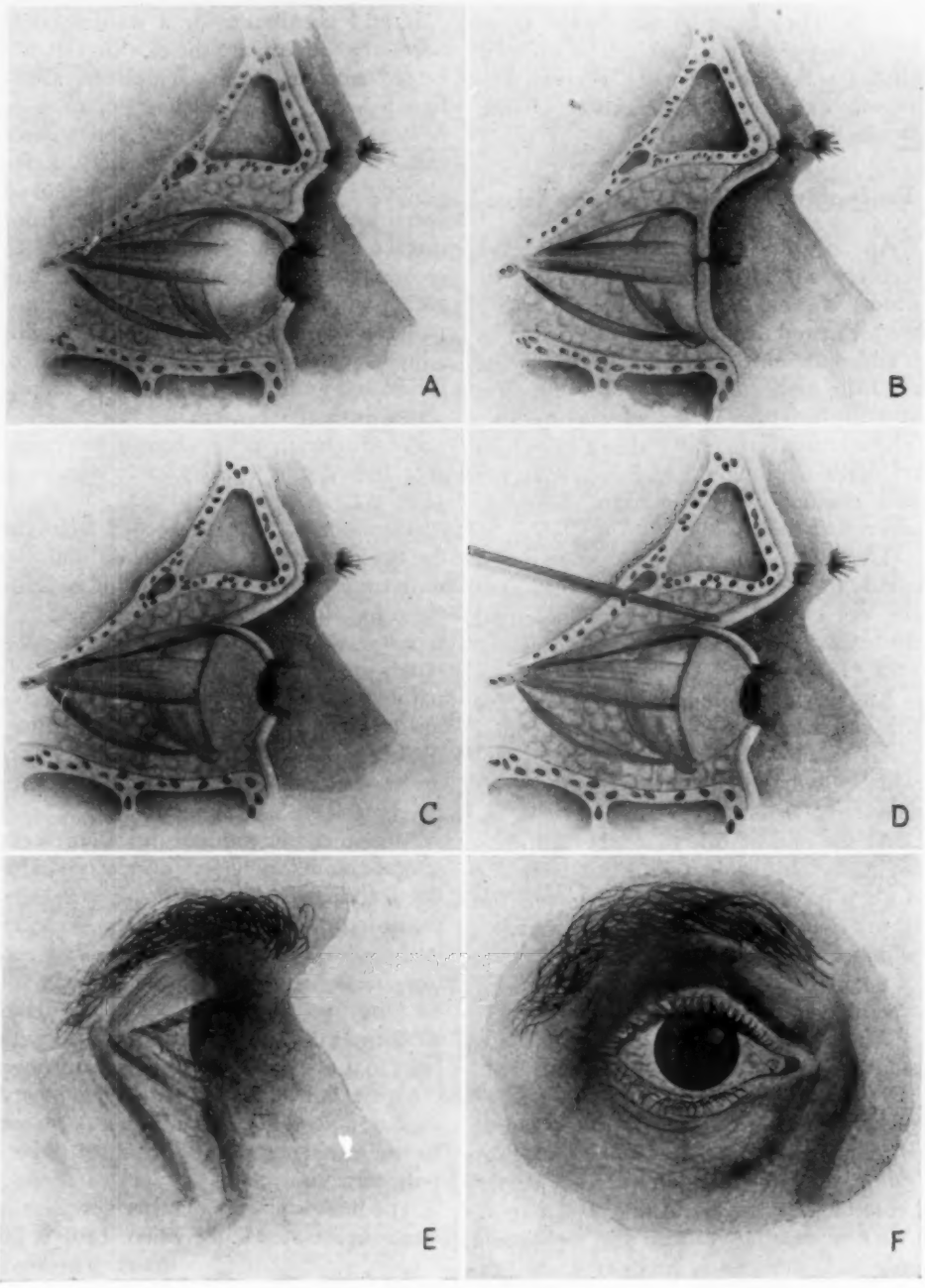


Fig. 1.—A: Normal lid conformation of natural eye in position. B: Characteristic depression following evisceration. C: Previous Type of prosthesis. D: Facial contours are not restored. E and F: The orbital region is sunken and the upper lid is collapsed because the restoration fails to replace the space occupied by the natural eye

camera. They must be exactly the same before the picture is taken. The finished photographs will provide correct anatomic guides in the creation of the prosthetic replacement.

The Impression, Wax Pattern and Sclera

An accurate impression of the socket is prepared. Fifty cubic centimeters of water, lowered to approximately 75 F. are measured into a mixing bowl. To this is added alginate impression material, the retarder first, followed by the powder, and the mixture is stirred one minute. The mixture is then placed in a glass barrel, with a plunger which extrudes the mix through a rubber nursing nipple severed at the tip.

The glass plunger forces the material evenly through the rubber nipple, so that the eye cavity is completely filled and the excess spread over the external eye area (Fig. 2,*A*).

An acrylic impression tray made for this purpose is now applied to the material to further confine the impression, which will congeal in exactly four minutes (Fig. 2,*B*).

At the end of this time, the skin may be gently palpated to detach it from the impression material. After removal, the impression shows the irregular surfaces which have produced an exact negative of the eye socket. Eye secretions are easily removed under a stream of tap water.

After immersing the impression in a solution of potassium sulfate for fifteen minutes to allow it to harden, the impression is carefully filled with a strong working cast stone. A base is made by submerging the filled impression in the remaining cast stone in the plaster bowl. After separating it from the impression material, the cast is lubricated and enclosed in a plaster lock, and cut through its vertical dimension (Fig. 2,*C*). The vertical cut will allow removal of the wax pattern to be made and will allow a careful study of the cul-de-sac.

Liquid petrolatum or a similar oil is necessary to lubricate the cast thoroughly before making the wax pattern. One-fourth of a sheet of base plate wax is heated and forced into the plaster cast of the cul-de-sac (Fig. 2,*D*). After chilling, the wax pattern is removed carefully. Wax extensions on the front surface of the pattern may be added to compensate for tissue loss within the socket and for lost muscle tone. The completed wax model is smoothed down with a liquid soap solution, thoroughly washed, lubricated with liquid petrolatum and inserted into the eye cavity. Lid reaction and eye opening is checked to determine that the existing eye is closely simulated (Fig. 2,*E*).

The wax pattern is removed from the eye socket, sprues are attached and the pattern is invested in stone in a brass flask for duplication in acrylic. A lock is cut around the wax pattern, and a separating medium of sodium silicate is painted on the hardened stone. After this has hardened, the wax is removed thoroughly with boiling water and all surfaces are coated with alginate and allowed to dry.

Monomer is added to fluorescent scleral-colored polymer, carefully spatulated and the jar closed to allow saturation of the mixture. When the mix can be handled between sheets of moist cellophane without sticking, it is ready for packing into the lower half of the flask. The upper half of the flask is closed with bolts so that excess material ejects through the sprue hole. The plunger is then placed in this hole and a spring clamp placed to maintain constant pressure during polymerization.

The flask is placed in a thermostatically controlled water bath, where heat is increased slowly for four hours. The temperature does not exceed 135 F. for two hours, 165 F. for the next hour and a half and 210 F. for the last thirty minutes. The flask is cooled in tap water for twenty minutes before the sclera is removed. The

sclera is trimmed, polished and placed in the eye socket (Fig. 2,*F*) to determine the final contours of the area to be restored.

Location of the Iris

The iris is located by carefully matching the location of the iris of the existing eye and marking it on the surface of the sclera (Fig. 2,*G*). After removal from the eye socket, the iris area is filled in with india ink and allowed to dry. It is replaced in the socket, and the position of the completed iris is checked carefully (Fig. 2,*H*).

The sclera is again removed and wax is added to the clear corneal area of the iris, a sprue is attached and the sclera is reinvested in the lower half of a brass flask. A lock is cut and the surfaces painted with alginate and allowed to dry. The upper half of the flask is poured and the cover of the flask bolted into position. When the plaster is set the flask is separated and the wax and sclera are removed.

The marked iris area is undercut with an inverted cone stone about 2 mm. below the surface, with the floor of the undercut slightly concave and extended to fit exactly the painted iris. The external surface of the sclera is now relieved with a barrel stone, to allow for the clear acrylic to be added, and left rough to receive the painting of the scleral area. The iris insert is checked with a paper pattern of the painted iris and placed in the desiccating oven. The temperature is kept at 110 F. until the sclera is ready for painting.

Duplicating Color and Anatomic Detail

The medical illustrator duplicates the iris which will be used in the acrylic eye. Using photographs of the existing eye, the exact size of the iris and pupil is determined carefully by measurement and comparison with the patient (Fig. 3,*A*).

The circumference of the iris is drawn with the basic water color on a special imported water color paper, using a diameter slightly smaller than the existing eye because the clear acrylic of the completed prosthesis magnifies the corneal area. The outline of the pupil is drawn with india ink, its diameter varying, depending on whether the completed prosthesis is to be worn as a daytime or as a nighttime replacement.

The basic background color is applied using water colors with imported pigments (Fig. 3,*B*). The color is built up from a dark background to a light finish. The pattern which varies with each patient is painstakingly created, using the patient as a model, until the right effect is achieved. The iris striae are duplicated, and pupillary bursts are likewise reproduced. These, together with petechial spots of bright reds, yellows, browns or whites, portray the individual anatomic characteristics present. At various stages of the iris duplication the painting is desiccated to remove any excess moisture that could have been absorbed.

When the iris is completed (Fig. 3,*C*), it is carefully studied and compared with the patient under various lighting conditions, and various light reflecting angles. The final result is not complete until desiccation has been finished and an exact replica has been reproduced. The iris is left in the desiccating oven (Fig. 3,*D*) until it is ready to be placed in the insert in the sclera.

The sclera is given its basic color, using water colors with organic pigments. Variations in color intensity of the sclera in different areas are reproduced using the patient as a guide. Should pinguecula or pterygium characteristics be present, they are placed in corresponding areas of the sclera, together with variations of red, blue, yellow, or white highlighted areas in either the inner or outer canthus of the eye (Fig. 3,*E*).

Blood vessels are drawn, duplicating the course and diameter of each vessel with pens and fine pointed sable brushes

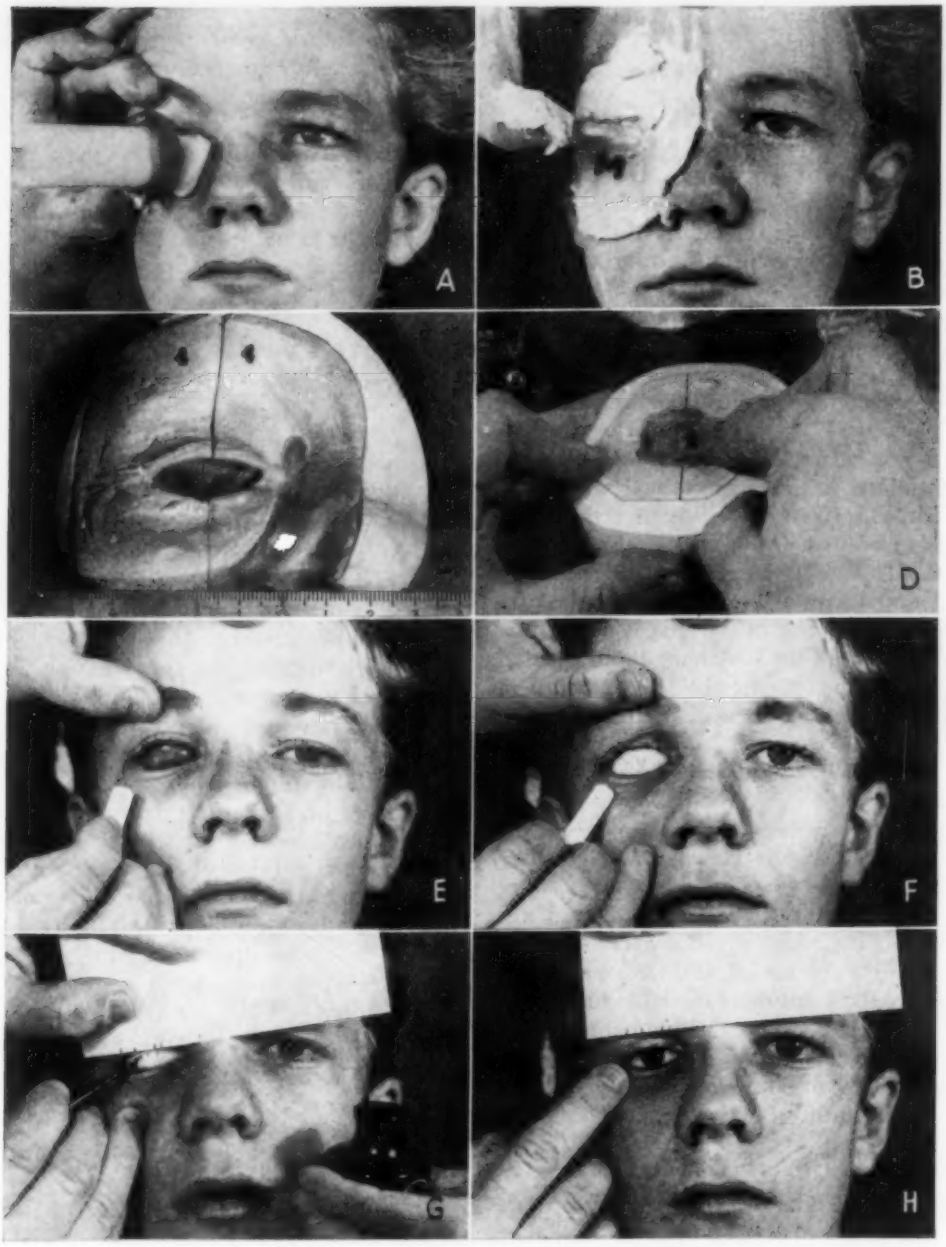


Fig. 2.—A: The impression material is forced evenly into the eye cavity, and the excess is spread over the external eye area. B: An acrylic impression tray is applied to the material to confine the impression. C: Cast enclosed in a plaster lock and cut through its vertical dimension. D: Base plate wax is heated and forced into the cast. E: The wax pattern is checked for accuracy. F: When the acrylic sclera is made, it is placed in the eye cavity to determine the final contours of the area to be restored. G: The iris is located by matching the location of the iris of the existing eye and marking it on the surface of the acrylic sclera. H: It is replaced in the socket and the position of the completed iris is checked carefully

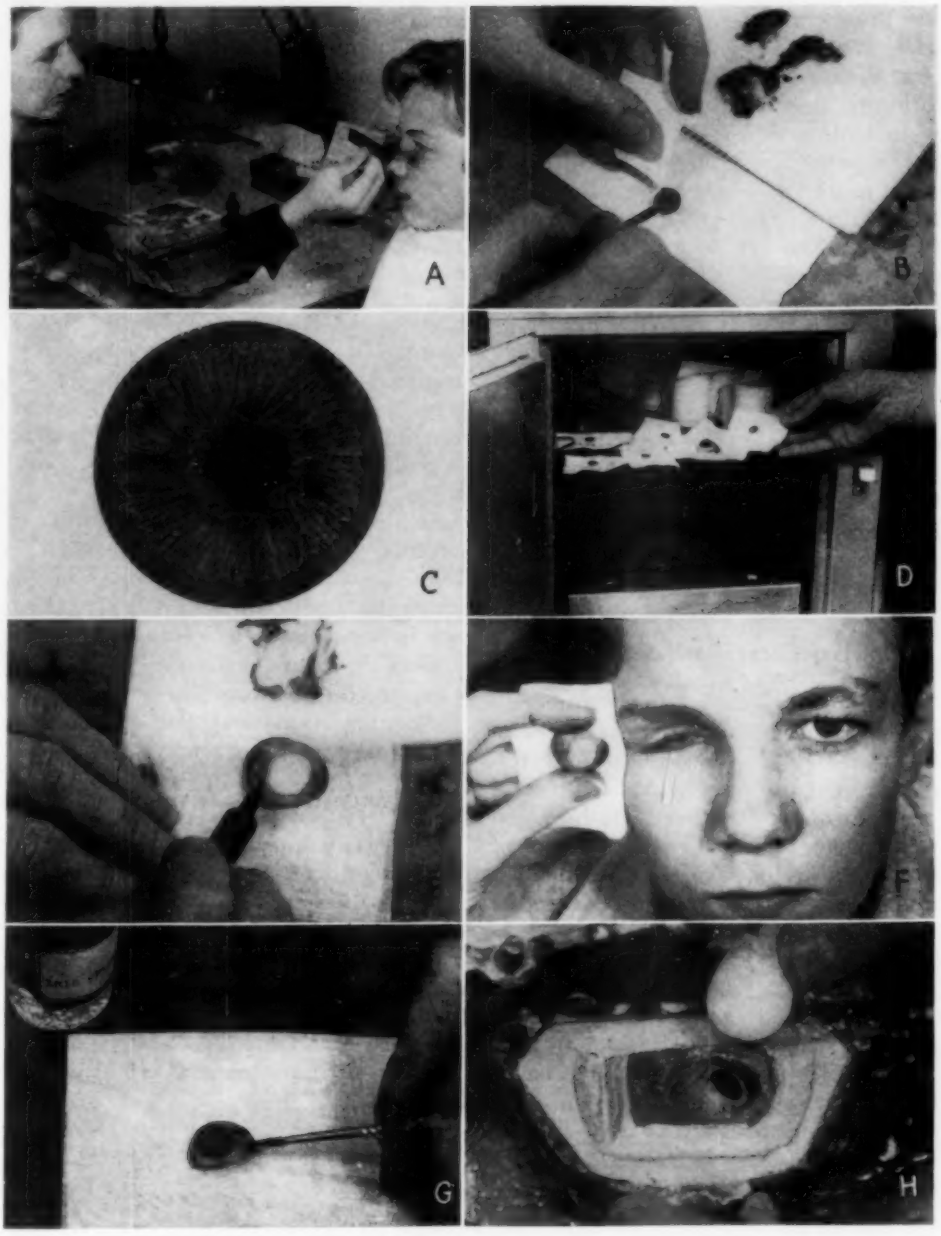


Fig. 3.—A: Size of iris and pupil determined by measurement and duplicated by the medical illustrator. B: The color is built up from a dark background to a light finish, using water colors. C: Anatomic characteristics are duplicated. The completed iris is compared with the patient under various lighting conditions. D: Completed iris is placed in desiccating oven until it is placed in the insert in the sclera. E: Sclera receives basic scleral color and blood vessels. F: After desiccation, the sclera is checked with patient for discrepancy in color intensity. G: Iris is inserted and the entire prosthesis is coated with solution of methyl methacrylate. H: The prosthesis is seated in the lower half of the flask and the clear mix is placed over it

which vary in size. After desiccation, the sclera is carefully checked with the patient for any discrepancy in color intensity to insure an exact replica in color tone and anatomic detail (Fig. 3,*F*).

The paper iris is now stationed in its insert using a 5 per cent solution of methyl methacrylate to cement it to the floor of the socket. After this has set at room temperature the entire prosthesis is carefully coated with a 5 per cent solution of methyl methacrylate (Fig. 3,*G*) and allowed to dry at room temperature for twenty minutes. To insure polymerization of the methyl methacrylate solution, the prosthesis is placed in the desiccating oven, the temperature is raised gradually to 165 F. and kept at this temperature for fifteen minutes. This completes all necessary desiccation and only organic substance remains.

The Clear Corneal and Scleral Areas

The prosthesis is now ready to receive the clear corneal and scleral areas. The lower half of the flask is carefully tinfoiled, using the 5 per cent solution of methyl methacrylate to cement the tinfoil to the stone surfaces. The upper half of the flask is tinfoiled in the same manner using a gold foil burnisher to adhere the tinfoil to the stone in all areas.

Monomer is added to fluorescent clear polymer, using about one-fourth the amount used for the scleral mix. This is carefully spatulated and allowed to saturate. After saturation, the mix is removed from the jar and handled between sheets of cellophane to insure absolute cleanliness. The prosthesis is removed from the drying oven and seated into the lower half of the flask. The clear mix is then placed over the prosthesis (Fig. 3,*H*) and pressed firmly in place, after which the upper half of the flask is bolted in position. The excess material comes through the sprue hole.

The plunger is placed in the sprue hole and the spring clamp is applied to maintain constant pressure during polymerization. The assembled flask is now put in the water bath (Fig. 4,*A*) again and the temperature is increased to 130 F. for forty-five minutes, to 165 F. for the next forty-five minutes and increased to 210 F. for thirty minutes.

The Completion of the Anatomic Prosthesis

After the flask has cooled for twenty minutes in tap water, the prosthesis is removed and excess flashing trimmed off with a barrel stone. The scleral sulcus around the iris is accentuated with an inverted cone stone (Fig. 4,*B*). The prosthesis is polished carefully with goat's hair bristle brushes and finely powdered flour of pumice. The final high polish is obtained with a rag wheel and powdered chalk paste with water (Fig. 4,*C*). Minute indented areas which the rag wheel cannot reach are polished with a small mounted bristle brush. The patient wears the replacement several hours before final adjustments are made.

Advantages of an Adequate Restoration

Many advantages of this acrylic replacement are evident. A comparison of the eyes (Fig. 4,*D*) shows the coloring of the iris and sclera to be exactly duplicated, with the reflection of light in the corneal area identical in location. The intense light necessary for color photography has contracted the pupil of the natural eye more than average lighting conditions.

The previous facial contour (Fig. 4,*E*) is restored with the eyelashes curling out from the greater lid in a normal curvature. An analysis of the face reveals normal contours from both the front view and the profile view. The greater lid is restored to its former fullness, and the palpebral sulcus fits into the area between the iris and the intraorbital bulge, giving a natural appearance.

The cross section painting of the an-

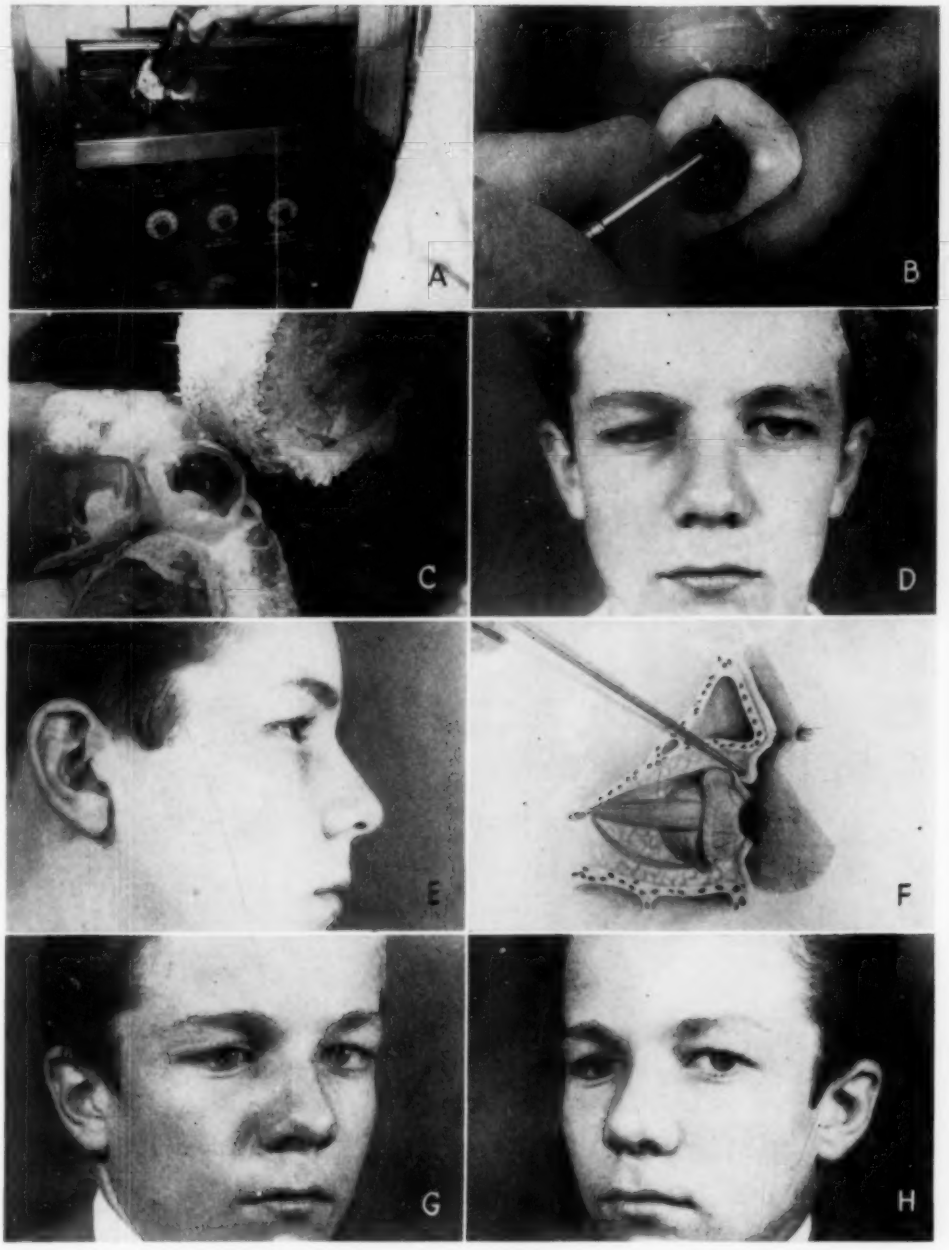
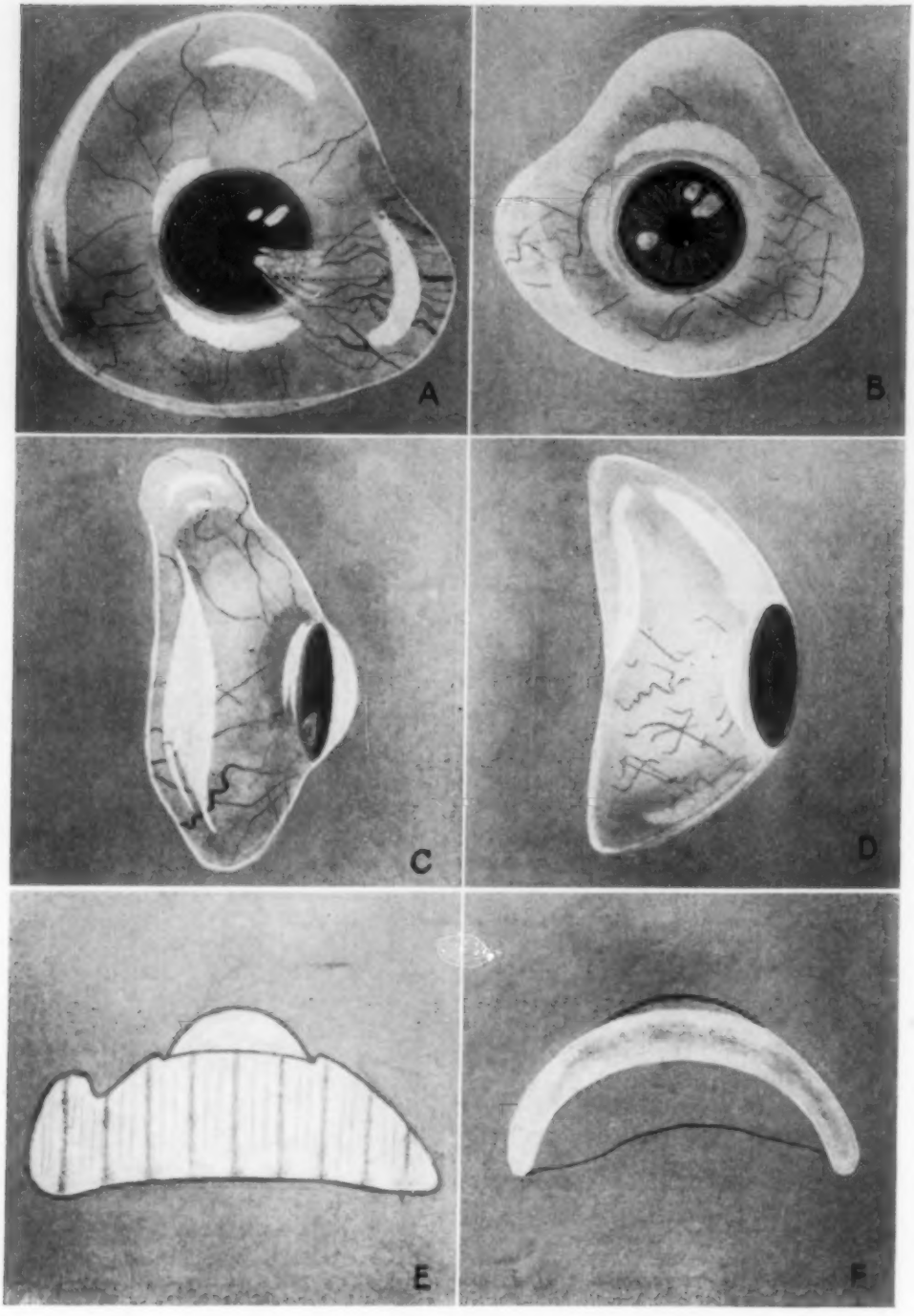


Fig. 4.—A: Thermostatically controlled water bath insures polymerization. B: Placing the scleral sulcus. C: The final high polish. D: Comparison shows duplication. E: Previous facial contour restored. F: Drawing of anatomic prosthesis in position shows restoration of muscular portion by intraorbital bulge. G: The eyes move together normally, the replacement moving with the natural eye to the right. H: The replacement follows as well to the patient's left, eliminating the necessity of turning the head when the range of vision is changed


A
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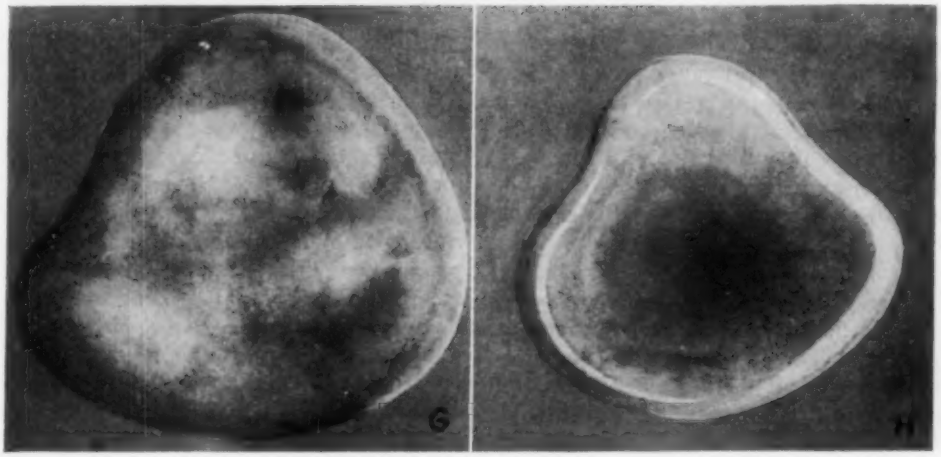

Fig. 5.—Opposite page. Morphologic comparison of the anatomic prosthesis with previous types. A: Anterior surface. B: "Window" surface. C: Lateral view of the anatomic prosthesis shows the intraorbital bulge to restore facial contours; the reflection of the iris color in the corneal area matches the existing eye, and the extension of the lower border of the prosthesis overcomes lack of muscle tone in the lower lid. D: Inadequate restoration. E: Vertical section. The back wall of the anatomic prosthesis follows the contours of the eye socket. F: Back wall is hollow and allows accumulation of secretions. Above. G: The uneven posterior surface of the anatomic prosthesis copies the characteristics of the back wall of the eye socket. H: Lack of continuous contact promotes hypertrophic tissue

atomic prosthesis in position (Fig. 4,*F*) clearly illustrates that the prosthesis occupies all the space formerly occupied by the lost eye and the surrounding tissues. The intraorbital bulge on the anterior surface of the prosthesis restores the muscular portion of the greater lid to its former position. This is held in place because the posterior surface of the prosthesis contacts all portions of the posterior wall of the eye socket.

The extension of the lower border of the prosthesis to fill out the fullest extent of the cul-de-sac in the lower lid area eliminates the possibility of the lower lid displaying a sagging or depressed appearance.

The eyes move together normally, the replacement moving simultaneously with the natural eye to the right (Fig. 4,*G*). The replacement follows as well to the patient's left (Fig. 4,*H*), eliminating the necessity of turning the head when the range of vision is changed.

Summary

The advantages of this anatomic prosthesis over previous types may be summed up as follows:

1. Variations in temperature will not cause an explosion of the anatomic prosthesis in the eye socket, as often happens with a glass prosthesis. The acrylic prosthesis will not break easily and it is easily polished or adjusted.

2. Changes in color and fogginess of the cornea after wearing in the eye socket does not occur with the anatomic eye prosthesis. This property is present because the anatomic eye prosthesis is all organic substance and earth pigment which has been thoroughly desiccated.

3. The posterior surface of the anatomic prosthesis conforms exactly to fit

the posterior wall of the eye socket. In previous prostheses the concavity of the posterior surface promoted eye secretions of mucous and watery discharges which etched the surfaces, necessitating replacement at six month to two year intervals. Furthermore most scleral areas did not copy the anatomic details of the existing eye.

4. Watercolor drawings emphasize further the original morphology and other salient features of the anatomic prosthesis. The anatomic face of the prosthesis shows all the technical details of the natural eye minutely reproduced. Compare the difference in morphology and detail between the anatomic prosthesis on the left and the previous type on the right as shown in Figure 5,*A* and *B*. By taking an impression of the eye socket, reproducing a working cast and wax pattern to fit, the particular characteristics of each patient can be duplicated.

5. The lateral view of the anatomic prosthesis (Fig. 5,*C*) shows the intraorbital bulge to restore facial contours; the reflection of the iris color in the corneal area matches the existing eye, and the extension of the lower border of the prosthesis overcomes lack of muscle tone in the lower lid. The morphology of previous types of prosthesis (Fig. 5,*D*) possibly was determined by mechanical convenience to the artisan.

6. The vertical drawings of the prostheses (Fig. 5, *E* and *F*) emphasize the difference in outline. The back wall of the acrylic prosthesis is not hollow, but is solid and follows all the contours of the back wall of the eye socket. This makes it impossible for eye secretions to accumulate within the cul-de-sac, because with the anatomic prosthesis there is no area which does not contact all portions of the cul-de-sac uniformly. Secretions, therefore, accumulate while sleeping, in the inner and outer canthus of the eye, similar to the natural eye.

7. The uneven posterior face of the anatomic prosthesis (Fig. 5,*G*) has copied the characteristics of the back wall of the eye socket. This greater contact with the orbital tissues provides an opportunity for increased muscle invigoration and aids in the movement of the prosthesis, causing it to follow the natural eye. In previous types the lack of continuous contact (Fig. 5,*H*) inhibited movement and promoted hypertrophic tissue. The typical appearance of a cul-de-sac, after the patient has worn an anatomic prosthesis, shows a smooth firm, pink appearance of healthy conjunctivae which the prosthesis has made possible.

8. The psychologic value of an adequate anatomic eye prosthesis is expressed by the patient's feeling of self-assurance and restored confidence.

Conclusion

This ophthalmoprosthesis research report has stressed only the outstanding advantages of this technic. Further evolvement of the technic to civilian requirements of eye loss has come from the Maxillofacial Prosthesis Department of the Richmond Freeman Memorial Clinic, The Children's Medical Center, affiliated with the Ophthalmology Department of the Southwestern Medical College. This department has worked as a team and in every instance has collaborated with an eye physician, a qualified ophthalmologist who is a member of the staff, or otherwise associated with recognized medicine.

From Caligula to the present time is more than two thousand years. Even in the last one hundred years progress in ophthalmoprosthesis has not advanced rapidly. It has taken World War II to evolve this presentation and congeal a definite technic into usable clinical form.

DENTAL INFECTION AND EXTRAORAL DISEASE

Walter H. Nadler, M.D., Chicago

THIRTY-SIX years have passed since Billings[1] formulated the theory of focal infection. That bacteremia might follow a local infection had, of course, been well known. When the primary infection was evident and productive of symptoms and when manifestations of injury to distant tissues or organs were acute, there never had been much difficulty in recognizing a probable relation between the initial and the metastatic lesion, nor, indeed, in assuming a cause and effect relation. However, when the primary focus was asymptomatic and to be found only after special search, and when signs of lesions in distant organs suspected of being secondarily involved were chronic, it was difficult or impossible to prove any connection. Diphtheria had long been recognized as a classic example of a localized infection producing distant and selective toxic manifestations. The experimental studies of Rosenow[2] demonstrated that streptococci carried in the blood stream frequently found conditions in various tissues that favored their growth.[3]

A great variety of acute and chronic diseases were originally attributed to focal infection, with improvement naturally to be expected from eradication of the responsible focus. Thirty-six years ago it seemed—and it may still be true—that a large proportion of sick and not a few apparently healthy persons harbor foci of chronic infection, particularly about the teeth.

Acceptance of the theory of focal infection was immediate and enthusiastic, and treatment was zealous. Questionable as well as definitely infected teeth were removed wholesale and often as a matter of routine. Billings had stated that "deplorable as the loss of teeth may be, that misfortune is justified if it is necessary to obliterate the infectious focus which is a continued menace to the general health." The joker lay in determining whether an infectious focus actually was a continued menace and sometimes in deciding whether a questionable tooth really harbored infection. As time went on it was found that many patients were not, in fact, benefited by extraction of their teeth. It was recognized, of course, that regional glands might then have become secondary depots or that organisms lodged in distant tissues might themselves have become responsible for the persistence of symptoms. Another focus or more than one might be operative, in the nose and throat or in the genitourinary tract, for example. It finally became clear that factors other than infection, factors such as dietary deficiency and debility due to other diseases, might play a part and that their correction might even render a focus of infection innocuous.

A reaction to too much zeal was inevitable. After some twenty-five years, as

Read at the eighty-ninth annual session of the American Dental Association, Chicago, September 14, 1948.

1. Billings, F., *Focal Infection*. New York: D. Appleton & Co., 1916.

2. Rosenow, E. C., Results of Experimental Studies on Focal Infection and Elective Localization. *M. Clin. North America* 5:573 (Sept.) 1921.

3. Irons, E. E.; Brown, E. V. L., and Nadler, W. H., Localization of Streptococci in the Eye: A Study of Experimental Iridocyclitis in Rabbits. *J. Infect. Dis.* 18:315 (March) 1916.

the result of assembled clinical data, enthusiasm lessened. Reimann and Havens[4] condemned the routine extraction of teeth and tonsils and questioned the rationale of extracting teeth in the hope of relieving remote or general symptoms and diseases. Cecil,[5] in reporting that removal of infected teeth failed to relieve symptoms, particularly those of rheumatoid arthritis, made a broad generalization in selecting as the title for his address "The Rise and Fall of Focal Infection." The medical and dental professions now, it appears, are in some danger of underestimating the frequency and importance of focal infection. In the last few years virtually nothing has been added to knowledge of the subject and, except in articles in various professional journals, the matter has been largely neglected. It may be that the professions now have reached a sane state of awareness that careful study of the individual patient is necessary and, as far as dental infection is concerned, that cooperation between dentist and physician is desirable.

Problems of Focal Infection

The concept or definition of focal infection has undergone no change. From a circumscribed region of tissue infected with pathologic organisms, toxins or bacteria carried by the blood stream produce disturbances in remote tissues. Allergic processes may play a part. In young persons the tonsils are the commonest focus, and in older persons, the teeth. Also recognized as possible foci are the accessory nasal sinuses, the genitourinary tract, the gallbladder, the appendix and bronchiectatic areas in the lung. The organisms usually responsible are streptococci, gonococci, staphylococci and pneumococci. Most commonly produced are the following: acute, subacute and chronic infectious arthritis (in rheumatoid arthritis proof of infectious origin is lacking); neuralgia of the face and upper extremities; myalgia and myositis; acute and subacute nephritis and perinephritic abscess; ocular inflammations, notably iritis, keratitis and choroiditis; erythema nodosum, and phlebitis. In persons with any of these diseases, evidence of focal infection must be sought. The commonest sites, including the teeth, are suspect, and must be routinely examined and exonerated. In persons with valvular heart disease, the existence of dental infection should not be permitted. This is true, also, for those with diseases of unknown origin, such as multiple sclerosis, with heart disease or with peptic ulcer. In persons with infection in a neighboring area, such as chronic maxillary sinusitis, infection about upper molar teeth obviously should not be countenanced, and in those with thyroiditis any dental infection should be eradicated. Good dental hygiene is important for persons with tuberculosis, syphilis, diabetes or scurvy. Moreover, since general debility, vague gastrointestinal symptoms and decreased general resistance may be due to chronic infection, any foci about the teeth should be cleared up in persons with any of these.

As regards dental infection, mature persons are particularly predisposed. So many of them have gum retraction, pyorrheal pockets, pulpless teeth or retained root fragments that, as previously suggested, it would be of inestimable value if they could be assured, by removal of all suspicious teeth, of freedom from or cure of the various ills ascribed to focal infection. Routine roentgen examination of the teeth promised at one time to furnish information of decisive value, but this promise was not fulfilled. It turned out to be too good to be true.

4. Reimann, H. A., and Havens, W. P., Focal Infection and Systemic Disease: Critical Appraisal; Case against Indiscriminate Removal of Teeth and Tonsils. *J.A.M.A.* 114:1 (Jan. 6) 1940.

5. Cecil, R. L., Rise and Fall of Focal Infection. *Proc. Interst. Postgrad. M. A. North America (1941)*, pp. 301-304, 1942.

As the result of experience, the following observations appear justified:

1. Many apparently healthy persons have dental infection which for long periods produces no ill effect.

2. Roentgen examination of a pulpless tooth may fail to reveal evidence of infection that is present.

3. Although teeth give roentgen evidence of infection, culture of material from their roots may show no abnormality.

4. It is difficult to get reliable proof that an obviously infected tooth is responsible for distant disease.

5. Extraction of an infected tooth may fail to relieve the condition for which removal was advised. Reliance must, accordingly, be placed on presumptive clinical evidence and often on the therapeutic test of extraction.

It is clear that, as Burket[6] said, no definite rules can be established for the evaluation of oral infection in all cases. How, then, can one determine the procedure that is in the best interest of the patient? It is useful to classify teeth as sound, questionable or definitely infected. When pulpless teeth remain for long periods in the questionable class, treatment may well remain conservative. When serious involvement of some disant tissue requires eradication of every possible focus, however, there should be no hesitancy in sacrificing a questionable or suspicious tooth. If the patient does not have a condition that demands irreproachable dental hygiene, caution and avoidance of unnecessary extractions are justifiable. When the presence of infection is questionable, cooperation between the dentist and the patient's physician is imperative. When teeth are infected and immediate extraction is indicated, there need no longer be delay, since the hazards of extraction have been removed through the availability of sulfonamides and antibiotics. Sulfadiazine, 1 Gm. every four hours for twenty-four hours, has been advised to prevent the spread of infection.[7] Penicillin often is even more effective.

It is useful for the physician also to regard teeth as sound, questionable or definitely infected. A routine health examination presupposes examination of the mouth and teeth and inquiry as to dental care. Should there be much dental work and a history of pulpless teeth, roentgen examination is advisable unless this has been done recently and consultation with the dentist is possible. If the patient feels well, questionable teeth may be treated conservatively; gross infection, however, should be cleaned up in the interests of general health. The sick patient, on the other hand, needs careful study; when he has a condition that is commonly due to focal infection—for example, acute iritis or acute arthritis—the approach must be radical. There need be no delay, since oral surgical measures may be safely undertaken when penicillin or sulfonamides are used.

Two abstracts of cases may serve as illustrations of some of the problems involved.

Report of Cases

Case 1.—A man aged 44 stated that he had had rheumatic fever in his youth. Examination showed a systolic heart murmur, and in several pulpless teeth there were large regions of rarefaction. The patient refused to have these teeth extracted. Six years later, in 1941, an abscessed tooth was finally removed. After the extraction the patient became ill. When admitted to the hospital, he had been sick for five weeks, with fever, night sweats, fatigue, pain in the left shoulder and cough. An infected tooth socket was found to contain a root fragment, which was easily lifted out. Repeated blood cultures showed Streptococcus viridans. A mitral systolic heart murmur was audible, and roentgenograms of the chest

6. Burket, L. W., Systemic Aspects of Diseases of the Teeth and Oral Tissues. *J.A.D.A.* 31:550 (April 1) 1944.

7. Ensign, D. C., Oral Focal Infection: Its Status Today, with Particular Reference to Arthritis. *J. Oral Surg.* 3:89 (April) 1945.

showed "mitral configuration" of the heart. Petechiae and retinal hemorrhages were present, and red cells appeared in the urine. Fever continued for fourteen weeks, reaching 105 F. Blood transfusions, sulfanilamide medication and artificial fever therapy were unavailing.

Autopsy revealed subacute endocarditis of the mitral and aortic valves due to Str. viridans and associated acute myocarditis, massive multiple infarcts of the spleen and focal embolic glomerulonephritis, as well as old infarcts in both kidneys. Earlier dental care might have prevented invasion of the blood stream. When finally performed, extraction might have been safe if penicillin had been available. Even after the onset of endocarditis, penicillin might have effected a cure and added another case as testimony to the brilliant results obtained with this antibiotic in the treatment of a condition long thought to offer a hopeless prognosis.

Case 2.—A woman 31 years of age had had several attacks of pain and redness of the left eye, which had cleared up spontaneously. With the latest attack, photophobia was marked and vision became blurred. When she entered the hospital after five days of pain, she had typical severe iridocyclitis. Pyorrhea had been discovered and treated the previous summer. She was found to have two pulpless teeth, one of which showed marked rarefaction, while the other was "questionable." Focal infection was evident, and its relation to the iritis seemed clear. Intravenous injections of foreign protein and intramuscular injection of penicillin were given, and the two teeth were promptly extracted. Recovery was rapid. In this case immediate extraction was indicated, and penicillin practically eliminated any hazard.

Conclusion

I believe that the subject of focal infection continues to be important. With time have come appreciation of the limitations of its application and realization of the need for special study of the patient. Better criteria have been established for the evaluation of the condition of teeth under suspicion, with the result that fewer teeth are needlessly sacrificed. When oral surgical measures are necessary, new medical preparations make them relatively safe.—*8 South Michigan Avenue.*

▲

Duplication of Master Denture Models.—In the process of fabricating a series of metal horseshoe-shaped partial upper dentures, it was found that a number of these castings did not fit the master model or the mouth, particularly in the palatal areas. A discrepancy of from 1 to 3 millimeters between the casting and the palatal tissues was noted.

A study of the procedures involved revealed that a distorted casting investment model, particularly in the palatal areas, was produced by a too rapid cooling of the hydrocolloidal duplicating material.

In order to reproduce a master model most accurately, particularly when the ring-shaped duplicating flask is used, it is important to bench-cool the hydrocolloidal material until the initial set has taken place, after which the flask containing the material may be placed in a shallow container of cold water. Not more than one fourth of the flask should be in the water. After the hydrocolloidal material is cold to the touch, the entire flask may be immersed in cold water for the final chilling. By following this method of slow cooling, distortion of the hydrocolloidal mold may be minimized or eliminated with a resultant investment model that is a more accurate reproduction of the master model. (U. S. Naval Dental School, Bethesda, Md.)—*"Procedure for Accurate Duplication of Master Denture Models," U. S. Navy Medical News Letter, May 21, 1948.*

ORAL DISEASES AND TUMORS COMPLICATING PERIODONTAL DIAGNOSIS AND TREATMENT

Joseph L. Bernier, D.D.S., M.S., Washington, D. C.

An understanding of anatomy, physiology and pathology is essential to the diagnosis and treatment of periodontal disorders. Although most patients seeking periodontal treatment exhibit the obvious clinical manifestations of periodontal disease, frequently they have primary or secondary complications in the form of specific manifestations of systemic disease, or perhaps a tumor which is not readily demonstrable by clinical means. The periodontist must be familiar with diseases of the mouth so that he can accurately interpret conditions that may confront him in his practice. In a sense the periodontist is a practitioner in oral medicine, and as such he has the responsibility for diagnosing disorders in the mouth as a requisite to proper care of the patient. To this end he must spend some time in the study of the effect of systemic conditions on periodontal diagnosis and treatment. The time spent by the periodontist in such endeavor will provide an ample reward by increasing his ability to interpret the usual clinical pictures and by enabling him to outline and implement complete and satisfactory treatment.

It is not feasible to consider all the oral manifestations of disease in this discussion, but I have selected some of the more common diseases, including tumors, the clinical behavior and histologic detail of which should be well known to the practitioner. It is essential that some time be spent on the consideration of specific histologic changes, since it is at this point that the practice of periodontia borders on that of oral medicine. Successful periodontal treatment depends upon the utilization of many laboratory aids, such as roentgen examination, analysis of the body fluids and biopsy. These aids are of the utmost importance, especially when complications occur, in that they may add appreciably to the knowledge of the disease in question.

I should like to discuss, first, some of the superficial diseases which are purely local and others which have a systemic background, and, second, some of the problems of diagnosis and treatment of malignant lesions. I shall not describe the histologic changes of periodontitis, for although a thorough understanding of them is essential, I shall assume that the periodontist has this information and is equipped to utilize it in diagnosis and treatment.

Many rare oral diseases and tumors can be distinguished from one another and from the common periodontal diseases by histologic examination. The resulting information often simplifies the problem of therapy. Specific entities such as gingivitis gravidarum and granuloma pyogenicum may present problems in clinical diagnosis but be readily identified by biopsy. This is true of the blood dyscrasias also, although in studying these the periodontist often must go beyond the examination of tissues from the mouth and resort to such measures as sternal puncture.

Read before the Section on Periodontia, American Dental Association, Chicago, September 13, 1948.

Lt. Colonel (DC) U.S.A.; secretary and pathologist, Registry of Dental and Oral Pathology, American Dental Association; chief, Dental and Oral Pathology Section, Army Institute of Pathology, Washington, D.C.

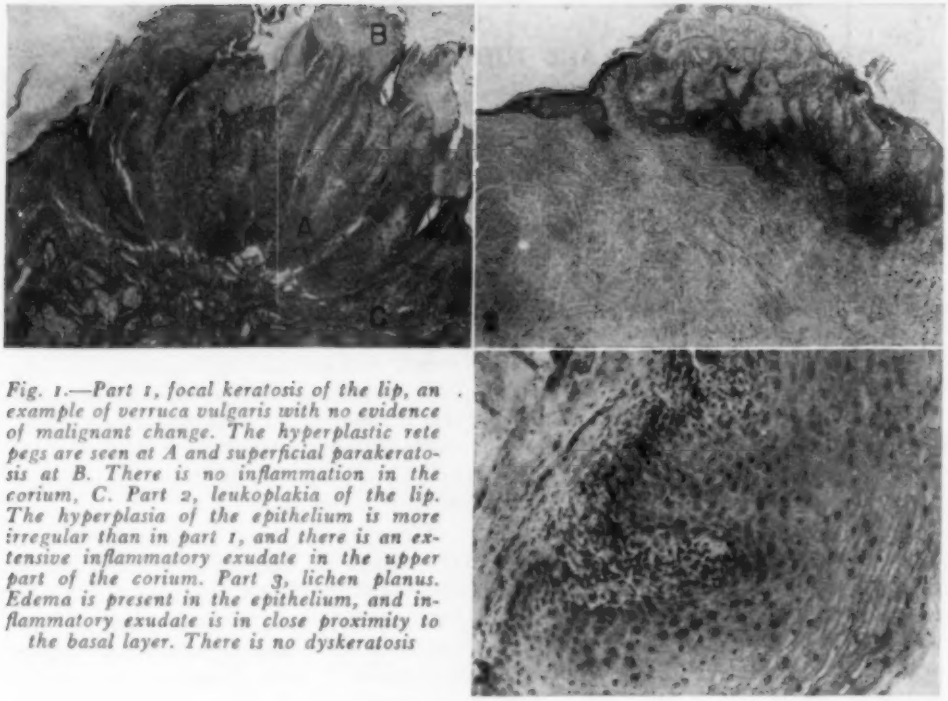

Fig. 1.—Part 1, focal keratosis of the lip, an example of verruca vulgaris with no evidence of malignant change. The hyperplastic rete pegs are seen at A and superficial parakeratosis at B. There is no inflammation in the corium, C. Part 2, leukoplakia of the lip. The hyperplasia of the epithelium is more irregular than in part 1, and there is an extensive inflammatory exudate in the upper part of the corium. Part 3, lichen planus. Edema is present in the epithelium, and inflammatory exudate is in close proximity to the basal layer. There is no dyskeratosis

The laboratory performs valuable service in securing specimens and in furnishing histologic analysis. In the diagnosis of tumors, careful roentgen examination affords some data, but it must be supplemented by histologic examination and other laboratory tests, especially if the lesions occur in the central portion of the maxilla or mandible, where they complicate the treatment of periodontal disease.

Superficial Keratotic Lesions

Such lesions as leukoplakia, lichen planus, focal keratosis and the verrucae do not as a rule involve the periodontal membrane; however, their presence in the mouth may present definite problems in periodontal treatment (Fig. 1). As a rule they must be treated by surgical or other measures before successful periodontal therapy can be instituted. In many instances the periodontist refers patients with these disorders to the oral surgeon; in fact, this is the usual procedure. However, the diagnosis can well be accomplished by the periodontist or general practitioner, who, of course, must have at his disposal all the usual laboratory aids.

It is obvious that periodontal disease cannot be eliminated through surgical intervention if multiple leukoplakic patches are present on the gingival mucosa. On the other hand, extensive surgical procedures in a mouth in which severe periodontal infection is present may be inadvisable. Lichen planus is usually confined to the cheeks and lips, but occasionally nodular lesions are seen on the gingivae, and although this disease is not as resistant to treatment as leukoplakia, its elimination is desirable before institution of periodontal procedures. In the presence of lichen planus, for example, it is often essential that the oral surgeon

and periodontist work together in determining the proper procedure.

Specific Gingival Diseases

Certain gingival manifestations are associated secondarily with inflammation, and it is necessary to regard them as distinct from periodontitis because of their specific nature. Examples are gingivitis caused by ingestion of diphenylhydantoin sodium and hormonal gingivitis (gingivitis gravidarum).

In the former condition, severe hyperplasia of the gingival mucosa may result from the continued use of diphenylhydantoin sodium, an active anticonvulsant used in the control of epilepsy. Some authors have indicated that the condition resembles scurvy in that the content of ascorbic acid in the blood is decreased. It has been pointed out, however, that the supplementary use of ascorbic acid neither prevents nor eliminates the gingival hyperplasia.

Other disturbances, such as dizziness, rash and fever, also have been attributed to the drug, but it is the reaction of the oral mucosa that is of interest to the dentist. The gingivae show marked overgrowth and often completely cover the crowns of the teeth. The reaction usually involves all the gingivae, both maxillary and mandibular. The clinical features of inflammation are not prominent, and hemorrhage seldom occurs. The covering epithelium is hyperplastic, with elongated rete pegs and increase in the width of the malpighian layer, and occasionally slight parakeratosis. The fibrous tissue in both the papillary and reticular layers of the corium increases in quantity, and the blood vessels become dilated and irregular. In the stroma, the bundles of collagen fibers are pushed apart by a chronic inflammatory exudate consisting of small lymphocytes and plasma cells, which tend to perivascular distribution. The inflammatory reaction is secondary; therefore this disease must not be considered a true form of gingivitis.

The gingival changes which occur during pregnancy in about 2 per cent of cases include simple epithelial hyperplasia, epuloid tumors and generalized gingivitis. They are believed to be the result of excessive secretion of hormone (chorionic gonadotropin). They usually begin in the second or third month of pregnancy and continue until the end of gestation, after which they may disappear spontaneously. The resemblance of gingivitis gravidarum ("pregnancy gingivitis") to acute Vincent's infection is often remarkable, and properly interpreted smears are of value in differentiation. The gingivae are inflamed and swollen and bleed easily; often they become deep purple and are extremely painful. Usually this reaction is generalized throughout the gingivae, although on occasion isolated "tumors" may form. Histologically the outer surface of the swollen gingivae may show ulceration with the formation of a fibrinous membrane. The intact epithelium is hyperplastic and somewhat edematous. The subgingival tissue contains many blood vessels, often neoplastic, which are dilated with blood. Proliferation of the endothelium is prominent, and as the lesion ages the vascular channels tend to assume adult characteristics. There is often a superimposed inflammatory reaction, in which small lymphocytes and granular leukocytes appear.

It is obvious, in view of their specific changes, that gingivitis caused by ingestion of diphenylhydantoin sodium and gingivitis gravidarum must be differentiated from the usual forms of periodontitis and, further, that their presence may seriously complicate periodontal therapy.

Benign Tumors

The peripheral fibroma arising in the periodontal membrane occasionally contains areas of calcification and sometimes bone and cementum. Generally it is attached by a flat pedicle, is roughly ovoid and, as usual with tumors in this loca-

tion, shows some surface ulceration. The calcified substance is usually deposited in foci throughout the tumor, which is composed of interlacing bundles of fibrous tissues containing cells with elongated or stellate nuclei. This lesion represents merely a variation of periodontal fibroma (Fig. 2, part 1).

Although some authors have expressed the belief that pregnancy and hyperparathyroidism may be of significance in the background of peripheral giant cell fibroma, the lesion probably is merely a local manifestation. There is a difference of opinion as to whether it is a true tumor or simply an exuberant granulation tissue response of the peridontal membrane to trauma. It does not invade contiguous tissue but grows outward into the oral cavity, often attaining the size of a walnut. Its color—bluish red to red—depends on the degree of vascularity and the thickness of the capsule. Like simple fibroma, it produces no symptoms unless it becomes extremely large or ulcerated.

The hyperplastic stratified squamous epithelium covering the tumor exhibits minimum keratinization and only occasional elongation of the rete pegs. The tumor itself is composed of a fibroangiomatous matrix enmeshing numerous giant cells, usually of fairly uniform size and intimately associated with blood vessels, sometimes being incorporated in their walls. The giant cells are of the osteoclastic rather than the foreign body type, although a few exhibit phagocytic properties (Fig. 2, part 3). It is the presence of these giant cells, together with the location of the tumor at the alveolar margin, which has caused it to be referred to as epulis, and its position makes it a serious problem to the periodontist. The fibrous tissue stroma is made up of actively growing fibroblasts, many of which resemble osteoblasts, and an increasing amount of collagen as the tumor ages. Hemosiderin and large collections of red blood cells are often observed. The loose, edematous areas noted in the fibrous tissue stroma make it necessary to guard against confusion with sarcoma. All peripheral fibromas associated with the periodontal membrane must be removed surgically before further periodontal treatment can be attempted.

Fibromatosis gingivae (elephantiasis gingivae) is a neoplastic condition making its appearance in early life. Its origin has not been satisfactorily explained, although both hereditary and endocrine factors have been suggested. Hypertrophic gingivitis is an inappropriate designation for this condition and should be reserved for hyperplasia resulting from an inflammatory process. In fibromatosis the reaction is generalized. The lesion is diffuse and has the appearance of multiple fibromas. The surface of the oral mucosa is smooth and does not bleed easily. Hypertrophy is sometimes so severe that the crowns of the teeth are covered. Differentiation from gingivitis due to diphenylhydantoin sodium usually can be accomplished on the basis of complete clinical history. Inflammation is not a feature unless it is secondarily imposed through trauma; occasionally ulcers occur and spread. Histologically the lesion is indistinguishable from simple fibroma (Fig. 2, part 2). Although recurrence is a possibility, surgical removal is specifically indicated. Fibromatosis may occur in association with periodontitis, and the latter can be treated satisfactorily after primary surgical removal of the hypertrophic tissue.

Bone Lesions.—Ossifying fibroma is a slow-growing benign lesion which is most often encountered in women in middle life. According to some investigators it is a true neoplasm of medullary origin; according to others, it is similar to fibrous dysplasia of bone. In its early stages of development, when the marrow is being replaced by fibrous tissue and newly formed trabeculae of bone (Fig. 3, parts 1 and 2), it has been called fibro-osteoma.

The term "hyperostotic" also has been applied, because the lesion may be characterized by relatively little resorption of bone. If fibrous tissue is abundant and bony trabeculae are just beginning to form, ossifying fibroma is regarded as a more accurate designation than the others for the lesion.

Expansive growth may produce considerable deformity, but the prognosis is favorable unless adjacent vital structures become involved. There is no constant microscopic picture. Certain lesions exhibit a loose, embryonic, fibrous, osteoid tissue matrix, in which new, thin trabeculae are noted. The spicules are usually outlined by osteoblasts (Fig. 3, part 3). The proportions of fibrous tissue and bone vary, and with time the bony trabeculae enlarge and the fibrous tissue becomes increasingly collagenous, while vascularity, initially prominent, diminishes.

Osteitis fibrosa cystica, the generalized decalcification of the skeleton, is mainly a manifestation of hyperparathyroidism. It generally affects middle-aged persons and is more common in women than in men. Osteoporosis is demonstrable in roentgenograms, the skull often showing a characteristic mottled effect and the mandible evidence of osteolysis. Diagnosis on the basis of microscopic appearance alone is difficult, because the picture is simply that of osseous repair. The outstanding change in the bone is extreme osteoblastic activity, especially in vascularized cortical areas, usually with some deposition of bone. In defective areas the bone is not deposited in lamellae but in a pattern closely resembling that of "woven" bone in the embryo. Fibrosis of the marrow is striking, and the extreme vascularity seen early in the process diminishes with age. The blood vessels show some evidence of thrombosis, and the presence of hemosiderin is evidence of hemorrhage. Cyst formation is common, although some authors have expressed doubt that it is an essential part of the disease. The cyst may be microscopic or large enough to be readily visible in roentgenograms.

Osteitis deformans (Paget's disease) is

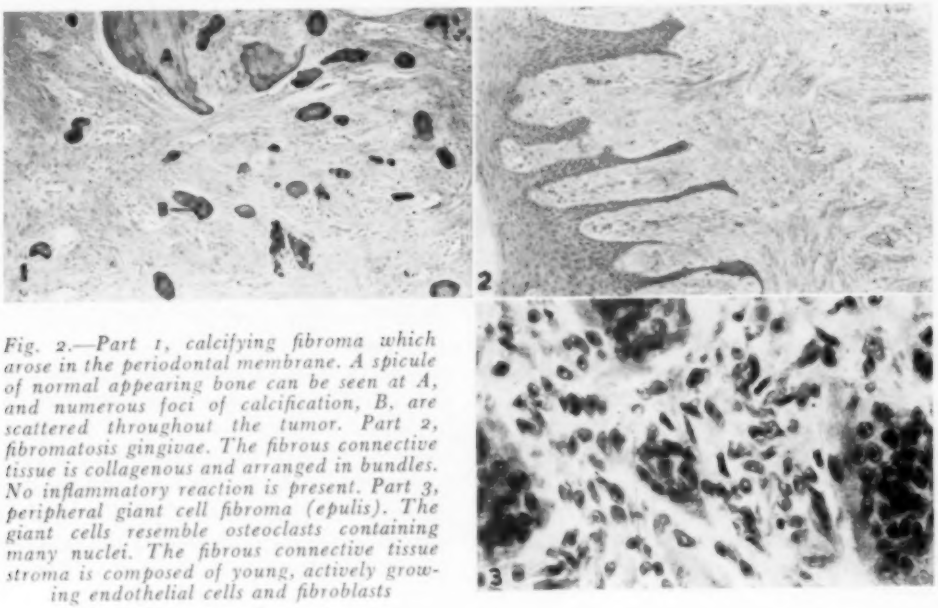

Fig. 2.—Part 1, calcifying fibroma which arose in the periodontal membrane. A spicule of normal appearing bone can be seen at A, and numerous foci of calcification, B, are scattered throughout the tumor. Part 2, fibromatosis gingivae. The fibrous connective tissue is collagenous and arranged in bundles. No inflammatory reaction is present. Part 3, peripheral giant cell fibroma (epulis). The giant cells resemble osteoclasts containing many nuclei. The fibrous connective tissue stroma is composed of young, actively growing endothelial cells and fibroblasts

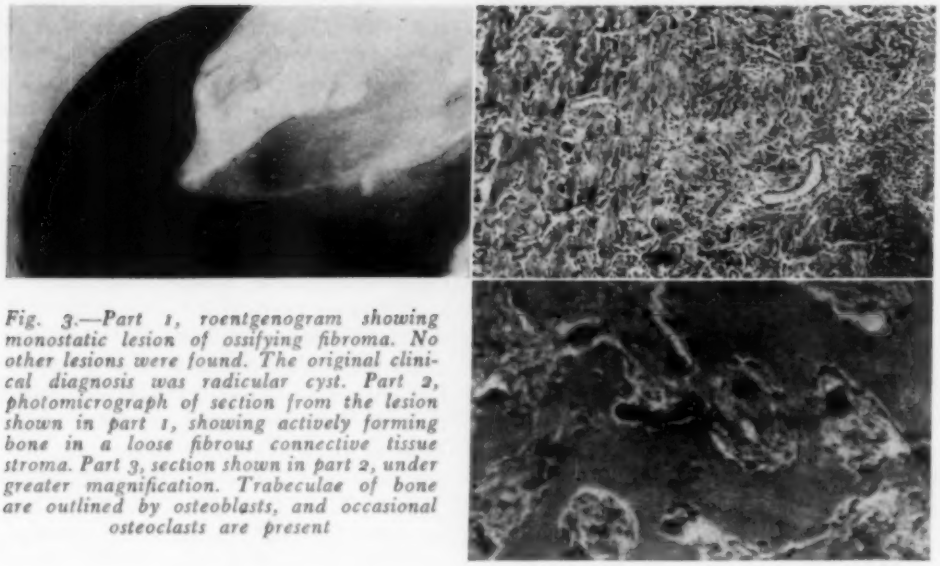

Fig. 3.—Part 1, roentgenogram showing monostatic lesion of ossifying fibroma. No other lesions were found. The original clinical diagnosis was radicular cyst. Part 2, photomicrograph of section from the lesion shown in part 1, showing actively forming bone in a loose fibrous connective tissue stroma. Part 3, section shown in part 2, under greater magnification. Trabeculae of bone are outlined by osteoblasts, and occasional osteoclasts are present

relatively rare and may affect only the bones of the skull and mandible. It is more common in women than in men and is usually seen late in life. Changes often occur in the jaw sooner than in other parts of the skeleton and are evidenced by loosening of the teeth as a result of excessive production of cementum on the roots.

Visible in the roentgenogram are fungating, superficial deposits of irregular bone, which produce enlargement of the part involved (Fig. 4, part 1). As the bones increase in size, patients may complain of difficulty in swallowing and chewing. Increase in the phosphatase and, to some extent, in the calcium content of the blood usually is associated with a decrease in the phosphorus level of the blood. (Fig. 4, part 2). Histologically, the bone structure appears fairly uniform throughout. Many osteoclasts are actively engaged in destruction of bone, but slightly in advance of this reaction is the constant deposition of new bone, producing a mosaic pattern which some authors have called significant in the histologic diagnosis. The laminations of the trabeculae are not as regular as in normal bone and are more prominent than in old cortical bone. As a rule, calcification is not as intense as that seen in normal bone (Fig. 4, part 3). In general, the histologic picture of the marrow is not changed as early in Paget's disease as in hyperparathyroidism. Although exudate may appear initially, fibrosis is delayed. It has been reported that the pulps in teeth involved in this process show exaggerated production of secondary dentin. The excessive cementum is usually poorly differentiated, as in new bone.

All these bone lesions may seriously complicate simple periodontal disease. In many instances extraction of the teeth is indicated so that the patient may be reasonably comfortable. Correct early diagnosis is of the utmost importance. The complicating manifestations may be so severe that the treatment of the periodontal disease may appear to be of little consequence. Although this may be true in some cases, in others proper treatment may save teeth for long and valuable masticating service. Periodontal treat-

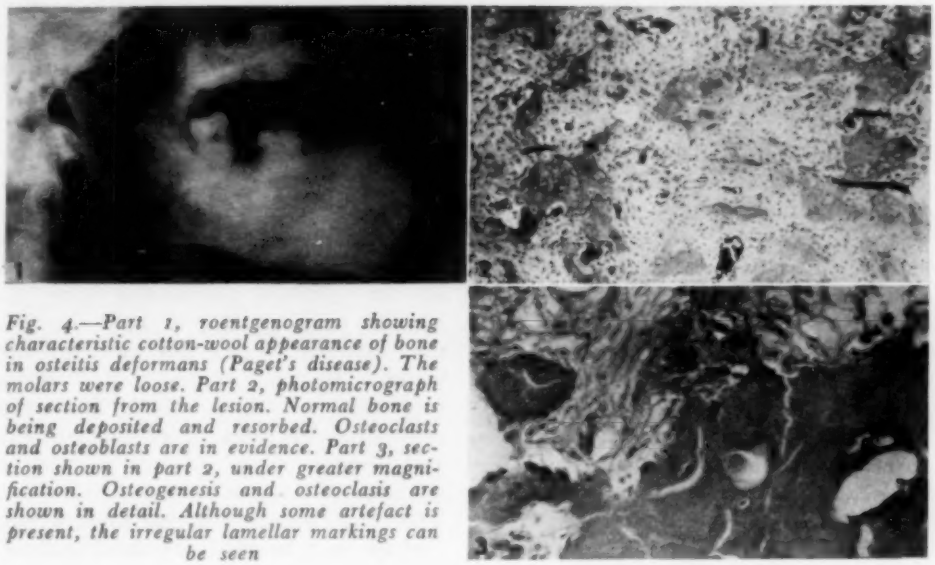

Fig. 4.—Part 1, roentgenogram showing characteristic cotton-wool appearance of bone in osteitis deformans (Paget's disease). The molars were loose. Part 2, photomicrograph of section from the lesion. Normal bone is being deposited and resorbed. Osteoclasts and osteoblasts are in evidence. Part 3, section shown in part 2, under greater magnification. Osteogenesis and osteoclasis are shown in detail. Although some artefact is present, the irregular lamellar markings can be seen

ment must usually be modified because of the lesion, but whatever can be done to preserve the masticating mechanism will add to the comfort of the patient.

Eosinophilic Granuloma.—First described in 1940, eosinophilic granuloma has been said by many to represent an early phase of Hand-Schüller-Christian disease. It occurs in children and young persons, producing tumor-like destructive lesions of the bone. The lesions may be accompanied with such systemic manifestations as low grade fever, leukocytosis, increase of eosinophils in the peripheral blood and loss of weight, and there may be anorexia and exophthalmos. Roentgenograms show that the lesion is osteolytic, frequently involving a series of bones. When the jaws are affected, the teeth may become irregular and occasionally may be exfoliated. Cases have been reported in which the initial lesion resembled a periapical abscess and extended rapidly after extraction of the tooth. In others multiple lesions in the jaw were disclosed by complete roentgen survey. Histologically, the lesion is characterized by masses of lipoid-filled macrophages, which may not be present in the early stages of the disease. There is often considerable fibroblastic activity at the periphery of the lesion; this may be explained as a reparative process or a secondary manifestation incident to infection. The stromal background is a delicate reticular tissue, in which eosinophilic leukocytes and lipoid are enmeshed (Fig. 5).

Malignant Tumors

The buccal and lingual gingivae are not as frequently the sites of squamous cell carcinoma as are the mucous membranes in other areas of the mouth. This may be explained in part by the better development of the stratum corneum of the gingivae. The tumors which do occur may be aggravated by continued local irritation, and the prognosis is serious because of the likelihood of extension to the body of the mandible. A favorite site for such lesions is the angle of the body and the ramus, where ulceration as a result of secondary infection is common.

Carcinoma of the buccal mucous

membrane is usually preceded by long-standing leukoplakia, which has become resistant to treatment. Metastasis may be early and extension wide. The tumor ulcerates early, and the expanding rim is raised and indurated by the young subepithelial tumor nodules. The necrosis causes a foul odor; vessels may be eroded, causing hemorrhage. Teeth in the path of the spreading lesion may become loosened and exfoliated (Fig. 6).

Primary carcinoma affecting the bone substance of the maxilla and mandible has been reported. It is possible that it may arise from epithelial elements of the enamel organ or Hertwig's sheath. As it grows, carcinoma tends to expand the bone, and it usually is not discovered until damage is extensive. It may cause teeth in the area to become loosened and even to extrude from their sockets. For this reason the extraction of loose teeth should always be preceded and followed by careful examination of the adjacent structures.

In the files of the Registry of Dental and Oral Pathology is recorded the case of a white man, aged 21, who had swelling and pain in the jaw after extraction of two loose teeth. The operative wound did not heal, and a large, fungating, ulcerating mass developed, involving the right alveolar region and floor of the mouth. The tumor regressed after roentgen therapy, and a month afterward resection of the right side of the mandible and excision of the involved portion of the floor of the mouth were carried out. The tumor recurred within three weeks, and the patient died two months later,

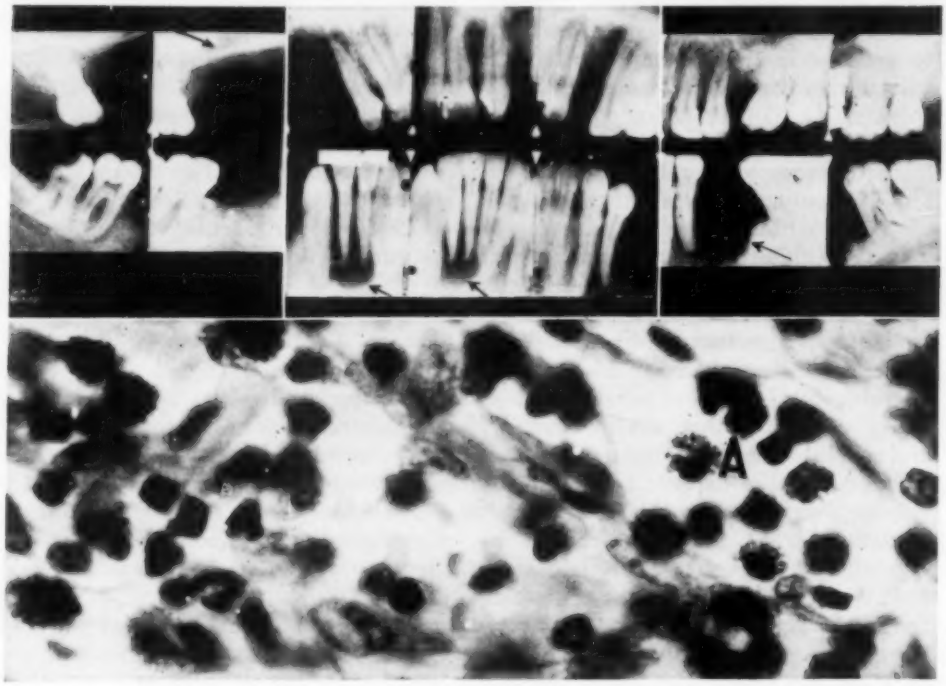

Fig. 5.—Multiple lesions of the jaw of a white man, aged 23. Similar lesions were present in the spinal column and ribs. Histologic examination established the diagnosis of eosinophilic granuloma. An eosinophil is shown at A

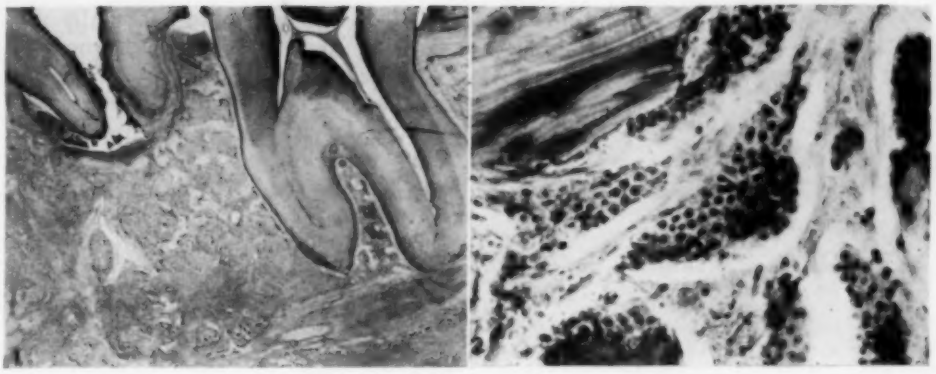

Fig. 6.—Metastatic squamous cell carcinoma involving the mandible. Part 1 shows that the marrow spaces as well as the periodontal membrane contained tumor elements. In part 2, the same section under greater magnification, nests of epithelial tumor cells can be seen. The primary lesion was in the prostate gland

despite further radiation therapy. Necropsy revealed extensive metastases. The tumor was an undifferentiated carcinoma with numerous mitotic figures and bizarre cell forms (Fig. 7). This case emphasizes the necessity of investigating the cause of loose teeth, especially if they are tender and painful and associated with paresthesia. The periodontist should always resort to biopsy in the presence of such symptoms. Early diagnosis and treatment might have resulted in a more favorable outcome in the case cited.

Histologically, squamous cell carcinoma exhibits marked variations, depending on the degree of differentiation attained by the tumor cells. Early lesions are manifested by hyperplasia of the epithelium with malignant dyskeratosis, the epithelium growing in finger-line projections into the underlying tissue. There may be accompanying hyperkeratosis or parakeratosis. Almost always an intense chronic inflammatory reaction is noted in the involved tissue, intimately associated with the growing strands of epithelium. The basal layer is often lost entirely, the tumor cells growing wildly in all directions and exhibiting varying degrees of anaplasia. The amount of keratin produced and the number and character of mitotic figures vary with the degree of malignant change of the lesion. In general, moderately malignant tumors produce a large amount of keratin and have few mitotic figures, while in the highly malignant forms the tumor cells are not differentiated sufficiently to produce keratin but exhibit more mitotic figures because of the increased rate of growth. The typical epithelial pearl of cancer seen in the moderately malignant forms is a landmark of diagnostic significance. The pearl is a central concentric whorl of keratinized cells blended into a zone of granular cells, which, in turn, are surrounded by well differentiated squamous cells, usually showing prickles. In old, extensive lesions the tumor elements invade the surrounding tissue to such a degree that local surgical measures are of little value. Tumors affecting the oral mucosa tend to ulcerate early and widely because of the lack of a well developed stratum corneum and because of the moisture and warmth in the mouth which favor infection.

Conclusion

While most periodontal diseases are essentially inflammatory manifestations, it is obvious that other specific and more

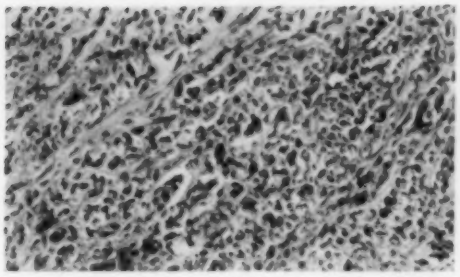

Fig. 7.—Undifferentiated carcinoma from the mandible of a 21 year old white man. The lesion was detected because the teeth were loose. Diagnosis was verified by biopsy

serious diseases may occur in the oral cavity simultaneously. In some instances they may appear to be associated etiologically with the periodontal manifestation, although this is not necessarily the case. From the standpoint of diagnosis it is essential that the true nature of any oral disease be thoroughly investigated, regardless of whether or not periodontal treatment is to be attempted. Often teeth may be retained even in the presence of serious disorders. Under such conditions it is usually necessary to modify the periodontal treatment; indeed, it may often be possible or advisable to combine such treatment with other surgical procedures, with emphasis on the more serious disease.

It is important that all diagnostic procedures be utilized, particularly for lesions affecting the mandible or maxilla. The extensive treatment required for complicated disorders often can best be carried out by the periodontist.

NECESSITY FOR ROENTGENOGRAPHIC SUPPLEMENTATION OF CLINICAL DENTAL EXAMINATIONS, WITH ANALYSIS OF 100 CASES

Seymour A. Watsky, D.D.S., New York

The children included in this study comprised a random sample of 100 high school pupils receiving routine treatment at the clinic of the New York city vocational schools, Central Commercial High School, New York. Only 4 were found to be free from active dental caries. The major part of the group had been referred for the correction of known dental defects. The youngest was 14 and the oldest 21 (1 individual). The average age was 16.1 years; boys averaged 16.9 and girls 15.9 years. Sixty-seven of the group were girls and 33 were boys. All patients were on a free or a part pay basis. Fifty had previously attended clinics, 37 had received some care in private offices and 13 had received little or no care. Thirty-seven reported dental treatment had been completed one year or less prior to the present examination.

At the first visit all teeth were scaled and brushed with pumice paste. A 2 per cent solution of sodium fluoride was applied to the teeth of the odd-numbered patients for future study. Examination

was then made under good light with a mirror and explorer. Findings were charted by student dental assistants on the dictation of licensed dentists.

Next, four roentgenograms were made, two posterior interproximal views and an upper and a lower anterior view of the central periapical areas. (The number has since been increased to two posterior interproximal and four anterior periapical views to obtain a more satisfactory diagnosis in the cuspid areas. Limitation of time and funds dictated restraint in this respect.) Films were processed by student dental assistants and were interpreted by the writer.

Clinical findings were charted in red and roentgenographic findings in blue. Third molars were not included in the statistical analysis because these teeth were unerupted in most patients and because they were not completely visualized in many of the posterior roentgenograms. Interproximal decalcification which had penetrated the dentin or had reached the dentino-enamel junction was interpreted as carious. An effort was made to refrain from extremes in judgment. Shallower decalcifications were called to the attention of the operators for their information in treatment.

Teeth were recorded as D (decayed), RD (decay in any tooth that previously had been filled), M (missing), F (filled and presently caries-free) and X (indicated for extraction). Notation was made of other pathologic conditions observed in the roentgenograms. Where part of a pathologic area was visualized, or where diagnosis was doubtful, additional exposures were made. The operator performing each examination was indicated by name, but appears in the statistical analysis by number. The seven examiners were aware that their charts were to be checked with the roentgenographic evidence.

It will be seen from Table 1 that more than 21 per cent of the decayed teeth in the school children's mouths would not have been discovered in the absence of the roentgenographic examination.

Table 1.—General tabulation

Findings	D	M	F	Total
Clinical	475	135	378	988
Roentgenographic (in addition to clinical)	131			131
Total	606	135	378	1,119

Table 2 suggests that no operator should rely on his ability to discover all dental decay by mirror and explorer alone. The roentgenograms indicated that the average number of D teeth per child undiscovered by the seven operators ranged from 0.86 to 1.69. The over-all average number of undiscovered D teeth was 1.31 per child.

Teeth indicated for extraction or root canal filling (before cavities were excavated) in this series of 100 children numbered 44. Several more would have been added to this figure if data pertaining to pulp exposure after cavity preparation had been recorded. Added to the 135 missing teeth, it will be seen that the 100 children had lost or would soon lose more than 179 teeth.

The RD figures (included in D teeth in Table 1) were as follows:

RD on clinical examination	119
Additional RD on roentgenographic examination	72
Total	191

The indications, therefore, are that an average of 1.91 teeth that had been filled previously had become carious again and an average of 4.15 unfilled teeth were carious at the time of examination.

The total DMF figure indicates an average of 11.19 teeth decayed, missing or filled out of 28 teeth per child. This number would have been greater if third

Table 2.—Comparative ability of operators to detect cavities by clinical examination

Operator	Children examined	Additional D teeth found by roentgenograms	Average additional D teeth per child
1	21	21	1.00
2	26	44	1.69
3	9	10	1.11
4	13	21	1.60
5	20	24	1.20
6	4	5	1.25
7	7	6	0.86
Total	100	131	1.31

molars had been included in the analysis.

By adding the RD figure (191) to the total F teeth (378) we find that these children had had at least 569 teeth filled at one time or another, an average of 5.69 per child.

The 33 boys had 411 DMF teeth, an average of 12.45 each. The 67 girls had 708 DMF teeth, an average of 10.57 each. Since the boys were an average of one year older than the girls, this difference does not seem significant.

Table 3.—Miscellaneous pathologic conditions revealed in roentgenograms

Condition	Cases
Impacted cuspid	4
Impacted third molar, horizontal	1
Neoplasm of bone, tentative diagnosis	1
Congenitally absent tooth	4
Overhanging filling, gross	1
Periapical radiolucent area, misc.	6
Pulpotomy, apparently successful	1
Radicular cyst	1
Retained deciduous tooth	2
Root canal filling	
apparently successful	3
apparently unsuccessful	1
Residual root fragment	4
Total	29

Dental care is a continuous job. To be successful on a public health level, as well as privately, it cannot be conducted spasmodically. The child whose dental supervision ceases in the fourth year of elementary school becomes a dental casualty before he reaches high school. (The New York City Department of Health furnishes free dental care to a large number of underprivileged elementary school children in the fourth and lower grades. After that school level only a severely limited amount of emergency treatment is given.)

Diagnostic measures must be utilized to the fullest possible extent—particularly roentgenography. This study indicates that without roentgenograms 21 per cent of decayed teeth would have remained undiscovered. Delay until the teeth affected by hidden decay identified themselves by pain or enamel collapse would undoubtedly have resulted in the loss of most of them. Such a result causes loss of confidence in the value of dental care. Besides the economic loss to the individual and the community brought on by failure to discover and treat dental disease in its early stages, inadequate oral diagnosis in childhood and youth results in adults with hopelessly broken down jaw structures. This

situation was dramatically brought to light in the selective service examinations a few years ago.

In addition to early or hidden dental decay, 29 cases of other oral diseases or conditions predisposing to oral disease, some of them extremely serious, might have escaped detection (Table 3).

The school notification of dental completion should be amplified to include a statement that the child's dental condition has been found satisfactory by means of roentgenographic as well as clinical examination.—*639 West End Avenue.*

MANDIBULAR MOVEMENT AND ARTICULATOR OCCLUSION

L. E. Kurth, D.D.S., Chicago

THE controversy over the use of articulators, which has been going on for many years within the dental profession, has been based primarily on emotion and vested interest, rather than on an unbiased scientific analysis of actual mandibular movements compared with the occlusion of complete dentures as determined by articulator movement. All dentists are acquainted with the pseudoscientific claims made by some articulator manufacturers and their professional adherents about the close relation between their articulator occlusion and actual mandibular movement. It was therefore decided to construct complete dentures on such an articulator, according to the technic advocated by the manufacturer and taught in some dental colleges, and compare the resulting occlusion to the function of the dentures in actual use in the mouth during mastication.

The Hanau adjustable articulator was selected for this study, not because it is any better or any worse than any similar adjustable articulator, but primarily because it is representative of the group and is used for teaching purposes in many dental colleges. The end results noted here can be applied to any adjustable articulator.

Mandibular movements are the most complex of the various joint movements of the body. They may be divided into gliding, or free, movements and the actual chewing strokes of mastication. The mandible has a preponderance of possibilities in free movements, few of which are actually used during mastication. The boundaries of these free movements are determined by centric occlusion and the extreme limits of opening, lateral and protrusive movements which the musculature will allow. The actual chewing stroke is the most important of all mandibular movements and has been found to be a fusion of only the lateral and opening movements. There are absolutely no indications of a spherical movement of the mandible in mastication.

In a previous study[1] I made tracings of mandibular movements in mastication, and drew the following pertinent conclusions:

1. Kurth, L. E. Mandibular Movements in Mastication. *J.A.D.A.* 29:1769 (Oct.) 1942.

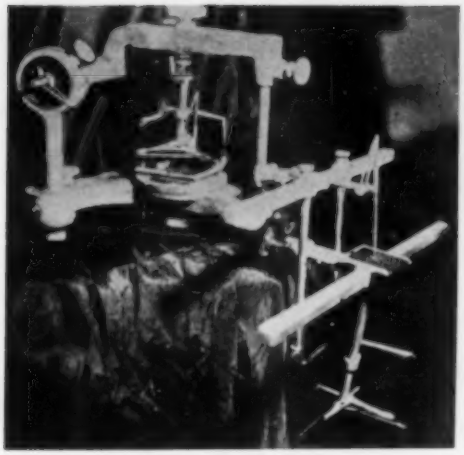

Fig. 1.—Hanau articulator, with tracing attachments used to obtain three dimensional tracings of articulator movement at the incisor guide pin and inside the bows of the articulator

The only clinical purpose of the gothic arch was shown to be the ascertainment of centric relation at a definite vertical opening. . . . The actual stroke of mastication is congruent with [the gothic arch] . . . for a very short distance toward centric relation. . . . A startling discovery on the horizontal plane at the incisor point was that the actual stroke of mastication was not contained within the included angle of the gothic arch. . . . The protrusive component is not used in mastication.

It was necessary to make similar tracings of articulator movements if they were to be compared with mandibular movements. Consequently, styluses and tracing plates were attached to the articulator, so that graphic tracings could be made in frontal, sagittal and horizontal planes at the incisor point and in the region of the first molar inside the bows of the articulator (Fig. 1).

Movement of Articulator Alone

The first study was of the movement of the articulator without any casts superimposed between its bows, for the purpose of determining just what effect variation of the condylar paths and Bennett movement would have on the tracings. A three dimensional tracing was made at the incisor point and in the region of the first molar with both condylar guidances and the Bennett movement set at 0 degrees. The direction of the lateral posts of the articulator, or the Bennett movement, was then changed to 10 degrees and another tracing was superimposed on the original one. There was absolutely no difference between these two tracings. The Bennett movement was changed to 15 and then to 20 degrees, and there was practically no difference in the tracings in any of the three dimensions. The condylar adjustments were fixed at plus 10 degrees, and more tracings were made, with alterations in the Bennett movement as before, and again there was little difference in the graphic tracing. The same results were obtained when the condylar guidances were changed to 20, 30, 40, 50, 60, 70 and 80 degrees.

These tests demonstrated that the Bennett articulator adjustment has no practical significance and absolutely no scientific purpose, and should not even be incorporated in construction of an articulator of this nature. Yet the adjustment has been recommended by the manufacturer, who devised a simple mathematical formula, $L = \frac{H}{8} + 12$, for the so-called accurate setting of the guideposts.

Further, close observation and comparison of the tracings made in the horizontal plane, including the composite tracing, which are indicative of the occlusal surfaces of the teeth, showed practically no difference among those made with adjustments from 0 to 80 degrees. This demonstrated that even the condylar adjustments have no practical significance as far as the relations of the occlusal surfaces in the horizontal plane are concerned. There was little difference among the tracings at the frontal plane, while the greatest degree of variance

among the tracings was in the sagittal plane in the molar region (Fig. 2). Both the manufacturer and the advocates of the articulator have attributed to these adjustments of the articulator much of their success in constructing complete dentures. Successful dentures have been and are being constructed with this and similar articulators, but a scientific interpretation of this technic shows that they are successful in spite of, rather than because of, the condylar or Bennett adjustments.

Experiments in Denture Making

To complete the study, impressions were taken, casts made and bite blocks prepared in the manner described by the manufacturer. The maxillary cast was mounted on the articulator by the use of the face-bow. Centric relation was obtained with the intraoral wax check bite and the mandibular cast was mounted on the articulator. A protrusive relation of 6 mm. was obtained with a wax check bite from the patient, and it was found

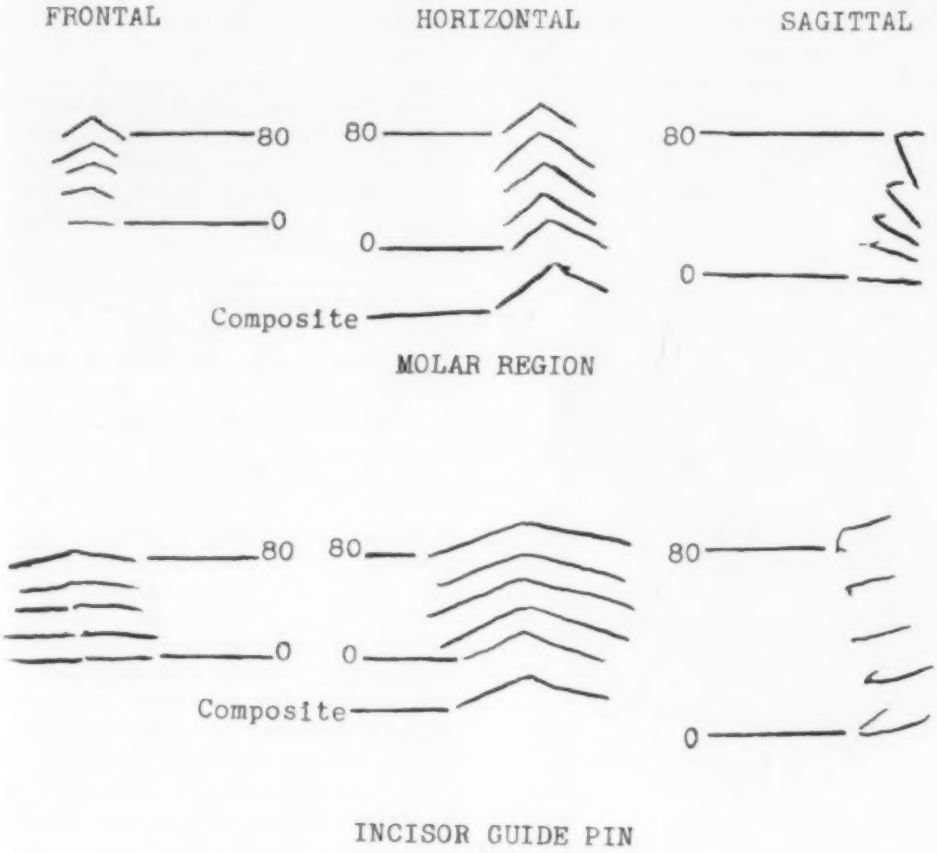

Fig. 2.—Graphic tracings of Hanau articulator made in the molar region and at the incisor guide pin, with changes in both the Bennett and condylar movements. Tracings were made with condylar adjustments from 0 to 80 degrees and changes in the lateral posts from 0 to 20 degrees. The tracings marked "composite" incorporate changes of condylar adjustment from 0 to 80 degrees combined with changes of the lateral posts from 0 to 20 degrees

that the condylar adjustments of the articulator had to be set to plus 25 degrees to allow this movement. The lateral posts of the articulator were set to about 15 degrees, according to the formula devised by Hanau.

The procedure of setting the condylar adjustments by means of a 6 mm. protrusive relation can be questioned. Prothero[2] many years ago said: "A protrusive movement of one-eighth inch or less, while capable of being registered, will not be sufficient to properly adjust the condyle slots of the occluding frame." A study of 147 adult patients with a complete complement of teeth showed that the average patient has to protrude the mandible 2.7 mm. before he can incise with his own teeth. A 6 mm. protrusive relation[3] would place the mandible twice as far forward as that of the average patient during function. Because a protrusive relation of 3 mm. or less would allow an infinite number of condylar angulations on the articulator, the manufacturer had to recommend that a movement beyond the normal incisive range be taken, so that the operator could set the condylar adjustments at a definite degree of angulation. The prosthodontist should be concerned primarily with the functional results, and there is no protrusion in an actual stroke of mastication.

If this technic is to be followed and the operator wishes to be scientifically consistent, the lateral component should be used for determination of the condylar adjustments of the articulator. It is well known that tracings made in the region of the condyles show a decided difference between lateral and protrusive movement. This is understandable when the anatomy of the temporomandibular joint is taken into consideration, for in true protrusion the condyle goes obliquely over its path toward the eminentia, whereas in a lateral excursion the working condyle goes squarely across the path (Fig. 3).

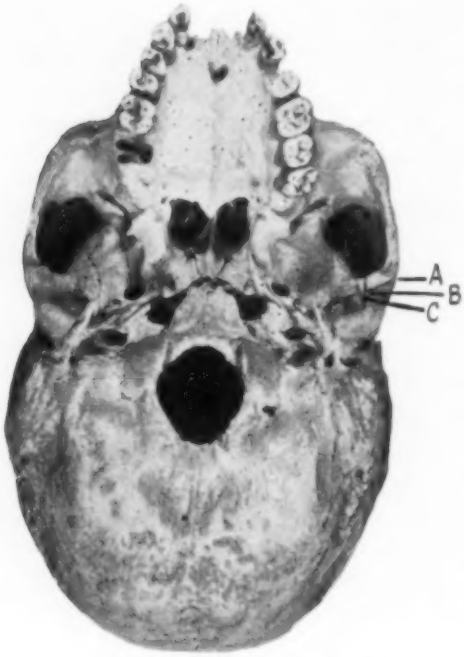

Fig. 3.—Section of skull. A, *angulation of eminentia articularis;* B, *line depicting direction of movement of the condyle obliquely over the eminentia when the mandible protrudes;* C, *line representing direction of movement squarely across the eminentia when a lateral mandibular movement is made*

Anterior teeth and 30 degree cusped anatomic posterior teeth were selected and set up according to Hanau's technic for the first articulator setting. They were tried in the patient's mouth for appearance and centric relation. When these were found to be accurate, several other setups were made for the same patient, with different types of posterior teeth and occlusions but the same articulator controls. For the second setting, 20 degree cusped posterior teeth were used; for the third, nonanatomic cuspless teeth set to a horizontal plane, from both a frontal and sagittal view; for the fourth,

2. Prothero, J. H., *Prosthetic Dentistry.* Chicago: Medico-Dental Publishing Company, 1916, p. 340.

3. Hanau, R. L., *Full Denture Prosthesis.* Buffalo: Hanau Company, 1930, p. 50.

nonanatomic cuspless teeth set to a reverse occlusal angulation from the frontal view (that is, the linguo-occlusal surfaces of the lower posterior teeth were at a higher occlusal level than the buccal surfaces); for the fifth, nonanatomic cuspless teeth set to a reverse angulation on the right side from a frontal view and to an 8 inch sphere on the left side; for the sixth, nonanatomic cuspless teeth set to an 8 inch sphere from both the frontal and sagittal views.

Centric relation was the same for all these setups, and the teeth were so placed that the utmost in balance according to the Hanau theory was obtained in incision and on the working and balancing sides. It was decided to use photography to compare the direction of movement of the articulator and of the actual dentures, functioning in the mouth, since the weight of the face-bow used in making a graphic tracing may alter the movement. Therefore, a pin with a white head was firmly attached in the interproximal space between the two lower central incisors of each setup, and stroboscopic photographs of movement of this bead in the frontal, horizontal and sagittal planes were made by the Armour Research Foundation of the Illinois Institute of Technology. Stroboscopic photographs in the three planes were made also of a white bead mounted on the incisor guide pin of the articulator

Results of Study

The patient was first instructed to make free lateral movements of the mandible to the right and left and to protrude, without using the opening component. The direction of such protrusion would be determined by the occlusion of the teeth and the glenoid fossa. Then the patient was told to describe a functional stroke of mastication, the direction of which was determined by the patient's habitual muscular pattern of opening and lateral movement. The stroke was completed when the patient reached centric occlusion. This movement was photographed in the three planes with all the six test dentures.

Similar photographs of the articulator were made with the same type of movement, namely, a glide determined by the condylar adjustments and the incisor pin and an opening movement combined with a lateral to approximate an actual stroke of mastication. As would be expected, the photographs of the movements of the articulator were found to be the same irrespective of the type of setup used. To demonstrate the dissimilarity of movement, the photographs of the articulator and those depicting the actual movements of the patient in the same plane have been combined.

Hanau[4] based the movement of his articulator on the premise that "Articulator and anatomical movements do not, and need not, coincide mathematically, but must be equivalent." Webster defined equivalent as being equal in measure but not admitting of superimposition. The only time articulator movements were equivalent to actual mandibular movements was in the glide, which the patient absolutely does not use in function. The wide variance in movement between articulator and patient appeared in the actual chewing or masticatory strokes, where the movement of the articulator was not equivalent but diametrically opposite in direction to the functional stroke of the patient's mandible.

Figure 4 demonstrates the movement of the mandible in the frontal view, compared with the movement of the articulator in this plane. Because the movement of the articulator was the same for all six dentures, only one photograph for articulator movement appears in this and succeeding figures. The free movements or glides for all the six types of occlusion

4. Hanau, R. L.,[3] p. 15.

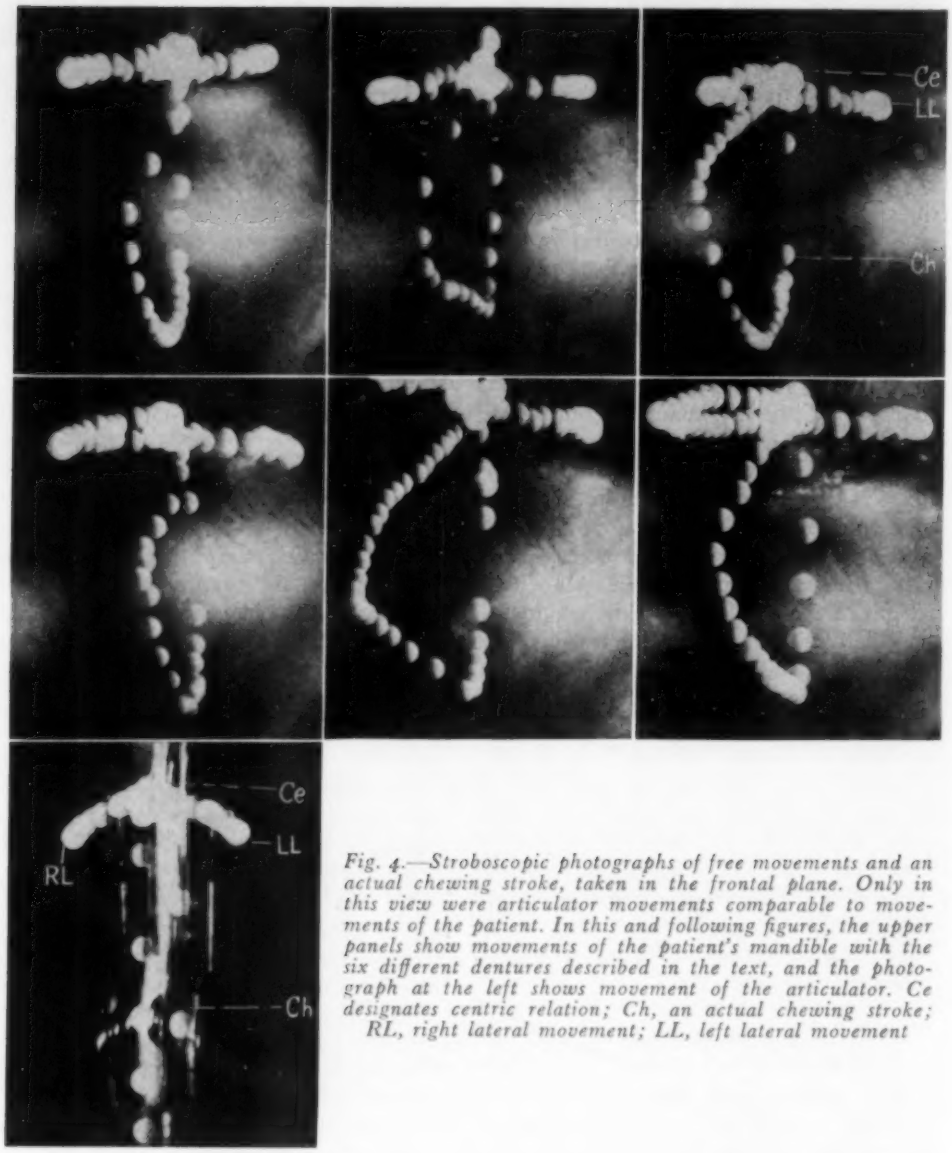

Fig. 4.—Stroboscopic photographs of free movements and an actual chewing stroke, taken in the frontal plane. Only in this view were articulator movements comparable to movements of the patient. In this and following figures, the upper panels show movements of the patient's mandible with the six different dentures described in the text, and the photograph at the left shows movement of the articulator. Ce designates centric relation; Ch, an actual chewing stroke; RL, right lateral movement; LL, left lateral movement

were practically the same except with the fifth denture. Here, because the angulations of the occlusal surfaces in the frontal plane were different on the right and left sides, the glide followed the occlusal angulation. It is interesting to observe that all the other glides were comparable, irrespective of the type of posterior tooth or the angulation of the occlusal surfaces.

The lateral movements can be clearly seen, and the fact that the actual chewing stroke did not follow these free movements is readily apparent. Centric relation for all six dentures was in the same location, for that is the end endeavor of either the free movement or the actual

stroke of mastication. The movement of the articulator shows the lateral or free movements as well as a simulated chewing stroke. Centric relation is clearly defined. The angulation of the free movements was more acute in the articulator than in the actual patient. However, in the frontal view the articulator movement can be called equivalent to the movement with the various dentures in the mouth. But one view does not give the complete picture. As far as movement is concerned, its direction must be studied also in the side and horizontal views.

A wide variance of direction of movement appears in the sagittal or side view (Fig. 5) when the actual masticatory movements are compared with articulator movement. With every one of the six dentures the patient's opening movement of mastication was in back of centric relation, and the type and setup of the posterior teeth had no effect on the movement of mastication. This further demonstrates the contention that the protrusive component is not used in an actual masticatory stroke. The right and left lateral components in the free movement, or glide, showed an element of protrusion, being in front of centric relation. The photograph of articulator movement in this plane demonstrates that the simulated chewing movement was within the confines of the gothic arch, with actual protrusion incorporated into this movement. Therefore, there is no equivalence of movement in this view. These photographs prove this fact conclusively, for they are placed in the same manner in which they were taken, and the curves of opening of the articulator and of the mandibular movement were exactly opposite.

Figure 6 demonstrates these movements from the horizontal or top view. This is the view utilized clinically in complete denture construction for finding centric relation at a definite vertical opening. It can be seen that with all the six dentures the patient, when instructed to make free movements to the right and left and to protrude the jaw, described the gothic arch or arrow-point tracing, which could be termed equivalent to the one described by the articulator. But the actual chewing stroke with all the six dentures took place posterior to centric relation, while a simulated chewing stroke on the articulator was contained within the confines of the gothic arch. The photographs from this view clearly demonstrate again that during functional mastication there is no protrusion, whereas in articulator action all movements are combined with protrusion.

It has been stated many times that the included angle of the gothic arch is the most important as far as movements of the articulator and of the mandible are concerned.[5] Evidence presented here proves that not this confined angle but the outside angle is most important in function. It would make a decided difference in the occlusal surfaces whether they were adjusted to move into centric relation from a protruded or a retruded chewing position. The articulator can move only from a protruded false position into centric relation, while the patient's jaws normally move into centric relation from a retruded open position. This fact disputes the possibility of the mandible's working on a pure hinge axis, for if it did it would follow the articulator movement. It also demonstrates that the type of tooth or occlusion incorporated into the full denture has absolutely no effect on the chewing cycle and little effect on the free movements of the mandible.

It can be seen that the only point at which the functional masticatory stroke is congruent with the gothic arch is near the centric position. Hildebrand[6] demon-

5. Simpson, Homer, Registration of Centric Relation in Complete Denture Prosthesis. *J.A.D.A.* 26: 1688 (Oct.) 1939.

6. Hildebrand, G. Y., *Studies in the Masticatory Movements of the Human Lower Jaw.* Berlin and Leipzig: Walter DeGruyter and Company, 1931, p. 104.

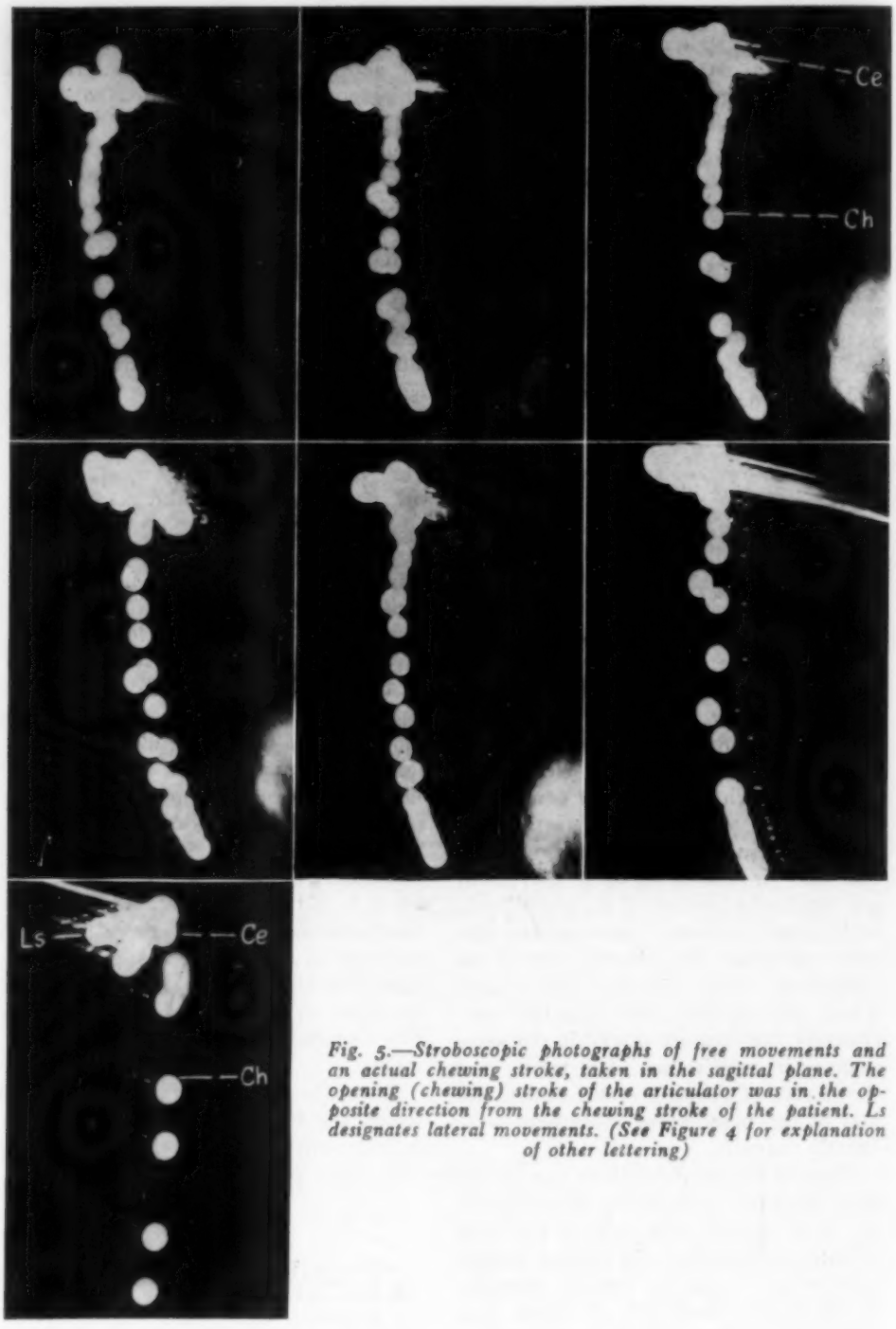

Fig. 5.—Stroboscopic photographs of free movements and an actual chewing stroke, taken in the sagittal plane. The opening (chewing) stroke of the articulator was in the opposite direction from the chewing stroke of the patient. Ls designates lateral movements. (See Figure 4 for explanation of other lettering)

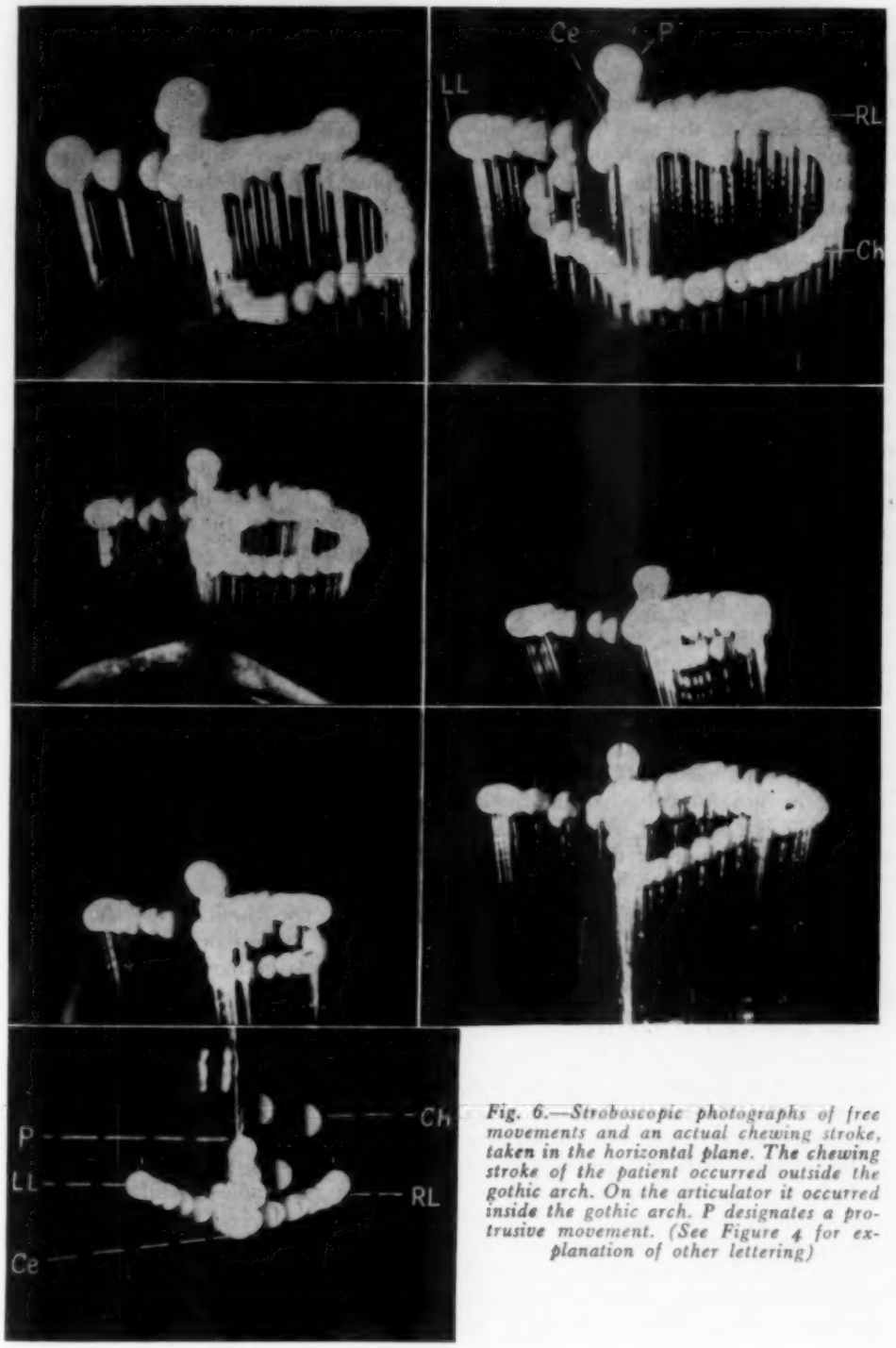

Fig. 6.—Stroboscopic photographs of free movements and an actual chewing stroke, taken in the horizontal plane. The chewing stroke of the patient occurred outside the gothic arch. On the articulator it occurred inside the gothic arch. P designates a protrusive movement. (See Figure 4 for explanation of other lettering)

strated conclusively that the range of lateral movement when the patient glides into centric occlusion is only 1 or 2 mm. at the incisor point. This distance would be infinitesimal in the region of the molars and might be less than the length of the inclined plane of the cusps. Therefore, the beliefs that there is a wide range of lateral movement in function at centric relation and that the use of a favorite articulator is necessary to insure accurate cuspal interdigitation are not based on scientific facts. This categorical statement applies also to the belief that occlusal paths should be developed by the use of wide lateral nonfunctional movements of the mandible.

The photographs further demonstrate that irrespective of the type of occlusion or of posterior teeth used in each denture, all the free movements and the actual stroke of mastication are equivalent in the mouth of the patient. There is no perceptible difference between cusped and cuspless teeth so far as direction of movement into centric relation is concerned. Therefore the importance of the correct location of centric relation cannot be overemphasized. The adjustable articulator has no value so far as its movement is concerned, for this movement is the antithesis of that of the patient. The instrument should be used only to maintain positional relations of the mandible to the maxilla.

Summary

The movement of the Hanau articulator was graphically traced in three dimensions with tracing pins and plates in the region of the incisor guide pin and the region of the first molar. Irrespective of the Bennett or lateral position of the condyle path, no perceptible difference was found in the tracings in any of the planes either at the incisor point or in the molar region. Little difference was found between the tracings when the condylar adjustments were changed, except in the sagittal views in the molar region.

A practical denture was mounted on the Hanau articulator by the recommended technic. Several different types of teeth and occlusions were then set up, and the results were stroboscopically photographed both on the articulator and in actual function in the mouth of the patient.

Conclusion

The following conclusions can be drawn from these experiments:

1. The only equivalent movements of the articulator and the patient are in the direction of the free movements or glide. These are not identical but occur in virtually the same direction. This is true irrespective of the type of tooth or occlusion used.

2. The actual chewing or masticatory strokes of the patient are diametrically opposite to similar movements of the articulator in the horizontal and sagittal views.

3. The importance of an accurate centric relation at a given vertical opening cannot be overemphasized, for all mandibular movements end at this point.

4. The included angle of the gothic arch has no functional value. The masticatory and opening movements in the patient are not found within this angle. Herein lies the greatest divergence between articulator movement and actual mandibular movement. Here, where all practical function occurs, the movement of the articulator is the exact antithesis of what actually happens in the mouth.

5. Neither the form of the posterior teeth nor the type of occlusion has any effect on function in the mouth.

6. The adjustable articulator has absolutely no value in movement, but if properly used can be helpful in maintaining positional relations obtained direct from the patient.—*180 North Michigan Avenue.*

A PRELIMINARY METHOD OF TESTING ABRASION HARDNESS

Fred A. Slack, Jr., D.D.S., Philadelphia

At the present time no routine test has been developed to determine resistance to abrasion of human enamel or artificial teeth. Penetration hardness, measured by the Brinell, the Knoop or the Rockwell method, has little relation to actual wear. This is evidenced by the fact that rubber, of a low hardness index, frequently outwears steel, of a high hardness index. Kessler,[1] of the National Bureau of Standards, described a method of determining the wear resistance of natural stone flooring. The equipment he used has not been standardized and is too massive for the study of such small objects as teeth. The two standardized abrasion testing machines, the Schiefer abrasion testing machine[2] and the Taber "Abraser,"[3] as yet have not been adapted to the testing of plastics, small specimens such as teeth and brittle materials like porcelain.

Thus, to determine the abrasion hardness of teeth it was necessary to adapt a standard instrument to the purpose and to devise a test that could be repeated by others, simply, with available equipment and with results that would have a definite relation to actual clinical knowledge.

Because of its simplicity, the Taber "Abraser" was selected for the purpose. The scale beam with 500 Gm. weight was used (Fig. 1).

The shear attachment was not used. Instead, the object to be tested was placed in the vise or attached to the scale beam by means of compound (Fig. 2).

Carborundum paper, 220 grit,[4] such as is used to level off calibrase wheels, was used as the abrasive. A new carborundum paper disk was used for each test.

The actual test method follows:

1. The scale beam was attached to the Taber "Abraser" and the weight adjusted to 500 Gm.

2. The object to be tested was weighed to the nearest milligram.

3. The object was effectively fastened to the scale beam at the normal position of the shear test attachment. It was fastened in the vise or attached to the scale beam by means of modeling compound. The object to be tested was carefully centered at the proper position, since the radius of the path would be changed if the object were off center. The radius of the path should be 40 mm.[5]

4. Liquid petrolatum was placed on the carborundum disk on the table to a depth of approximately ⅛ inch, to prevent clogging of the carborundum paper by the material being tested.

5. The scale beam was made absolutely level by means of the adjustment screw and a bubble level.

Vice-president, H. D. Justi & Son, Inc.

1. Kessler, D. W., Research Paper RP612. *Journal of Research of National Bureau of Standards*, vol. 11 (Nov.) 1933.

2. Manufactured by Sherman W. Frazier, Washington, D. C.

3. Manufactured by the Taber Instrument Corporation, North Tonawanda, N. Y.

4. The S 11 refacing disks were supplied by the Taber Instrument Corporation.

5. Since this article was written, the radius of the path has been increased to 45 mm.

Fig. 1.—"Abraser" with object in position for testing. The indicator on the scale beam is set at 500 Gm.

6. The indicator was adjusted to zero, and the switch was turned on.

7. The test may proceed as long as desired. However, for routine purposes 100 revolutions has been found best for testing of natural and artificial teeth.

8. At the end of the test the object was removed, cleaned with purified petroleum benzin to remove all wax and other foreign matter and reweighed.

9. The loss in weight for the specific number of revolutions indicates the abrasion hardness of the specimen.

It may be argued against the test that the abrasive carborundum paper will be worn down quickly by a substance harder than itself and practically unworn by a softer object. This argument is sound when more than 100 revolutions are used, and I have made no attempt to produce a straight line graph. But this defect only emphasizes the results attained, and cannot alter them essentially. It is my belief that the simplicity of the test and the relative values attained for various objects overcome the disadvantages.

Table 1 shows an effort to determine the range within which the wear of a plastic test specimen remains constant. Specimens 1, 2 and 3 were made of pure methyl methacrylate, and an area 12 by 3 mm. was exposed to the carborundum paper. It will be noted that the wear remained practically constant up to 100 cycles. Specimens were weighed at 50, 100, 150 and 200 cycles, the same carborundum paper being used for the entire 200 cycles.

The same test was applied to specimens 4, 5 and 6, which were blocks of pure methyl methacrylate half the area (6 by 3 mm.) of the first three specimens. The result was approximately the same, indicating that weight loss is nearly constant regardless of surface contact area. It was highly important to establish this fact as substantially correct, inasmuch as it is practically impossible to prepare human enamel specimens with a specific area of contact wear. Furthermore, 100 wear cycles is the maximum by which human enamel may be abraded, since additional cycles wear into the dentin of the human tooth.

Next it was necessary to determine the extent of the wearing down of the carborundum paper during the cycles. Obviously if the carborundum paper were to wear down significantly, the weight loss of the specimen would be decreased appreciably during the later cycles. A one cent piece was selected as an object for this test for a number of reasons:

1. The test may be easily duplicated by other persons with fairly constant results.

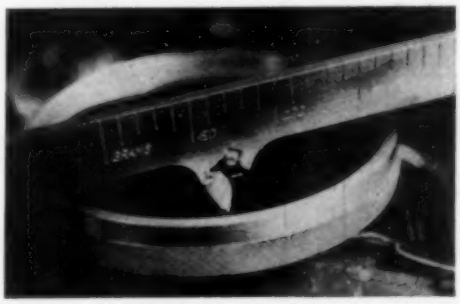

Fig. 2.—Test object centered and attached to scale beam with compound

Table 1.—Weight loss of test specimens. One piece of carborundum paper was used throughout the 200 cycles for each specimen

Specimen		Milligrams weight loss at 50 cycles	100 cycles	150 cycles	200 cycles
Plastic, area 12 by 3 mm.	1	38	64	110	146
	2	38	64	108	149
	3	38	64	102	136
Plastic, area 6 by 3 mm.	4	34	68	100	230
	5	36	70	104	126
	6	36	70	102	124
1948 one cent piece	7	17	32	48	69
	8	19	35	51	66
	9	16	33	53	67

2. The coin presents to the carborundum paper a harder and more resistant surface than does plastic.

3. It resembles restorative materials, such as gold crowns and inlays, which in the past have proved satisfactory for use in the mouth. (Gold itself could have been used, but duplication of the test by others would have involved undue expense.)

It has been suggested that a better abrasive material than carborundum paper might have been selected. The argument advanced was that an artificial substance with the same hardness as human enamel should be used to abrade test objects such as human enamel and artificial teeth. At first this argument seemed reasonable. But further consideration showed that experiments with such a substance would not test mainly the object under consideration, since a material harder than human enamel would be abraded slowly by a material only as hard as enamel. In fact, most abrasion would be on the testing device, rather than on the object to be tested.

It has been suggested also that a carborundum grit finer than 220 might have been used with a longer cycle. This also at first seemed reasonable, but the finer the grit, the more liable the testing apparatus is to clog. Clogging obviously voids the results, and it has been shown not to occur to a serious degree with the 220 grit carborundum paper when liquid petrolatum is used.

It must be understood that the purpose of this study was not to compare abrasion on the "Abraser" with that which actually occurs in the mouth, but to compare all objects with each other by means of a common abrasive substance, 220

Table 2.—Comparative weight loss of human teeth and other objects under test conditions described in text

Object	Weight loss, milligrams
Human teeth (within 1 hour after extraction)	
Central incisor	17
Bicuspid	12
Molar	15
Human teeth (more than 1 hour after extraction)	17 to 21
Dentin	57
1945 one cent piece	34
Artificial teeth	
A (methyl methacrylate)	62
B (methyl methacrylate)	60
C (copolymer methacrylate)	60.5
D (methyl methacrylate)	60
E (diacite methacrylate)	39
F (diacite methacrylate)	30

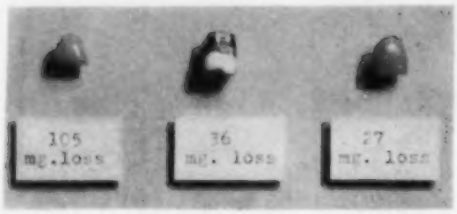

Fig. 3.—Methyl methacrylate tooth, human tooth and diacite methacrylate tooth after 200 revolutions against 220 grit carborundum paper with 500 Gm. weight

grit carborundum, used under identical test conditions. From the results listed in Table 2, it is reasonable to conclude that artificial tooth *F* was more abrasion resistant than artificial tooth *A*. It cannot be said that *F* had twice the abrasion resistance of *A*, or that it had half the abrasion resistance of human enamel, although direct comparison of the figures might indicate this to be the case. The figures actually show only that tooth *F* was more abrasion resistant than tooth *A*, and less abrasion resistant than human enamel.

Many analogies to other testing devices are possible. Most hardness testers use either a diamond point or a hard steel ball for testing and compare all materials relative to the indentation of the diamond or steel ball. In the same way, the foregoing test compares all objects to 220 grit carborundum.

Figure 3 shows results of 200 revolutions against 220 grit carborundum paper with a 500 Gm. weight on the Taber "Abraser." Test objects were artificial and natural teeth.

It is to be hoped that other investigators will repeat the tests, to the end that a means will evolve for accurately determining comparative wear resistance.

Conclusion

1. Two or more specimens such as teeth may be compared directly for wear resistance (abrasion hardness).

2. The testing device is available and requires no change for effective use.

3. The test method is simple, takes little time and gives reliably constant results on repeated tests.

4. The method shows abrasion resistance only, and is not related to the penetration hardness of the specimen tested. (All of the artificial teeth tested, except porcelain, had approximately the same Rockwell M hardness.)—*Thirty-second and Spring Garden Streets.*

▲

British Health Service Estimates.—The Civil Estimates for 1949-50 presented to Parliament last week show that the National Health Services in England and Wales and Scotland are expected to cost a gross sum £352,324,600, this being reduced by appropriations in aid to a net figure of just under £260 million. The General Dental Service in England and Wales is expected to cost just over £28 million, the estimated cost of the service in Scotland being £2,700,000. It is interesting to note that this latter figure is £100,000 less than the estimated expenditure under this head for the first nine months of the service. The cost of the Dental Estimates Board for the year is put at £320,000, approximately 1.1 per cent of the cost of the General Dental Service, whereas in Scotland the expenses of the Estimates Board are estimated to be £63,000 —2.3 per cent of the estimated cost of service.—*Notes and Comments, Brit. D. J., 86:184, April 1, 1949.*

THE METABOLISM OF MINERALS AND VITAMINS AND THE EFFECT OF SYSTEMIC CONDITIONS ON DENTAL CARIES

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THE role of minerals and vitamins and the effect of various systemic conditions in dental caries often have been confused through lack of basic information on the carious process. In dental caries there are two important sets of factors, exciting and predisposing. It has been clearly demonstrated through the years that dental caries is caused by acids formed within small bacterial plaques by microorganisms acting on carbohydrates. If acid of sufficiently low pH is produced and remains in contact with the tooth surface for a sufficiently long time, caries will be initiated. The important factors in the formation of acid are carbohydrates, which are readily available from food as it passes through the mouth, and enzymes derived from bacteria residing in the oral cavity or possibly from oral tissues or secretions. The acid is retained against the tooth surface and protected from buffering action of the saliva by the plaque, which is essentially a bacterial microcosm. The acidity of the whole saliva is not appreciably changed by the acid produced and active within the dental plaque.

It should be remembered that the process of dental caries is not initiated within the body, as are other bacterial diseases. It occurs within the oral cavity and outside body tissues which are capable of active inflammatory reactions. The bacteria are affected less by factors within the body than by the external factors of their environment, the oral cavity.

If any substance or condition is to influence dental caries, it must act through the direct or indirect etiologic agents. The direct agents include the carbohydrates, and acidogenic bacteria and those organisms which form the basic structure of the plaque. The indirect factors are present in the tooth itself, the saliva and the diet. In a consideration of the effect of minerals, vitamins and systemic disease, both classes of etiologic possibilities afford the keys (Table 1).

Studies proposing to show that caries is accelerated by certain diseases or deficiencies are misleading. Dental caries is practically a universal disease of mankind. When an endocrinopathy, a vitamin deficiency or a mineral deficiency appears, its victim may be expected to have dental caries, as do his healthier fellows. Too many studies based on the occurrence of cavities in the teeth of diseased persons have been made without consideration of the important fact that persons of comparable age, race, region of residence and social status have equal caries activity. Experimental studies and careful consideration of physiologic, developmental and pathologic observations afford better yardsticks.

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Table 1.—Factors to be considered in the relations of minerals, vitamins and systemic conditions—caries relationship*

Etiologic factors	Minerals	Vitamins	Pregnancy and lactation	General health and nutrition	Diabetes	Endocrine function	Infectious diseases	Emotional state	Constitution and heredity
					I. Indirect factors influencing caries				
A. Tooth									
1. Composition	1. During tooth development	1. During tooth development	1. None	1. During development	1. None	1. During development	1.	1.	1. During development
2. Morphology	2. During tooth development	2. During tooth development		2. development only		2. development only	2. Unknown	2. Unknown	2. development only
3. Position	3. During development of tooth and jaws	3. During development of tooth and jaws		3.		3.	3.	3.	3.
B. Saliva									
1. Composition	1.	1.	1. Unknown	1.	1. Unknown	1.	1. Variable or unknown	1.	1.
2. pH	2.	2.	2. None	2.	2. Unknown	2. Unknown	2.	2. Unknown	2. Unknown
3. Quantity	3. Unknown	3. Unknown	3. Unknown	3. Unknown	3. Decreased	3.	3.	3.	3.
4. Viscosity	4.	4.	4. Unknown	4.	4. Unknown	4.	4.	4.	4.
C. Diet									
1. Quality	1.	1.	1. Same as in non-pregnant women	1. Same as in normal persons	1. Same as in normal persons except where carbohydrate content is reduced	1. Same as in normal persons	1. Same as in normal persons	1.	1. Same as in normal persons
2. Carbohydrate content	2. None necessary	2. None necessary		2.		2.	2.	2. Unknown	2.
3. Fluorine intake	3.	3.	3.	3.	3.	3.	3.	3.	3.
					II. Direct causes of caries				
A. Carbohydrate degradation to acid (acidogenesis)	Not related†	Not related†	Same as in non-pregnant women	Same as in normal persons	Same as in normal persons	Same as in normal persons	Same as in normal persons	Same as in normal persons	Same as in normal persons
B. Proteolysis	Not related†	Not related†	Same as in non-pregnant women	Same as in normal persons	Same as in normal persons	Same as in normal persons	Same as in normal persons	Same as in normal persons	Same as in normal persons

*Modified from Reports of the Evaluating Committees, Relation of Systemic Conditions to Caries Process, *J.D.Res.* 27:491 (June) 1948.
†A deficiency of certain minerals and vitamins required by bacteria would have an adverse effect on the bacteria.

Role of the Minerals[1]

It can be agreed that certain minerals are important for formation of sound teeth, but there is no clear-cut scientific evidence that those minerals are necessary for prevention of disease in mature teeth.

There has been a tendency in the past to classify bone and tooth tissues together in discussions of the effects of mineral deficiency on growth of teeth. Although gross mineral deficiencies may lead to changes in composition, structure and form of developing teeth, the mature dental structures are not affected by severe lack of minerals or imbalance of minerals in the diet, as are bones. This has been demonstrated by Lund and Armstrong,[2] Gaunt and Irving[3] and others, and the reasons have been discussed by Schour,[4] Kronfeld[5] and Robinson.[6, 7] The most exacting experimental study was that of Kitchin, Sutton and Edwards,[8] who placed rats on a diet with a calcium-phosphorus ratio of 1 to 13 and combined this with repeated pregnancies. They reported that the inorganic material in the dentin of both the incisors and the molars was reduced, but that the inorganic material of the enamel was reduced only in the incisors, which are teeth of continuous growth.

Albright, Aub and Bauer,[9] Thoma[10] and Robinson and Koch[11] have observed cases of hyperparathyroidism in which massive removal of bone structures did not affect the tissues of the teeth. Schour, Tweedy and McJunkin[12] failed to find evidence of calcium removal from the molars of rats after parathyroidectomy and repeated pregnancies. The entire issue has been befogged by reports such as that of Vanzant and Phillips[13] of a single case in which hyperparathyroidism was associated with rampant caries in a 33 year old woman. That many healthy 33 year old women have rampant caries apparently never occurred to the authors, although they admitted, after operation, that "Whether or not the dental caries will be checked remains to be determined after the passage of time."

Radioactive isotopes have been used by a number of investigators[14, 15] to determine whether minerals can be introduced into the enamel and dentin of mature teeth. They reported that radioactive phosphorus can be introduced from the circulation into teeth, but that transport of ions between the teeth and the circulation is "feeble in comparison with that in the skeleton."

Fluorine should be mentioned as a mineral. The reduction of caries activity in population groups raised on naturally fluorinated waters or treated by topical applications of sodium fluoride has been

1. For a complete review of the relation of minerals and vitamins to dental caries, see Armstrong, W. D., An Evaluation of the Role of Vitamins and Minerals in the Control of Caries, *J. D. Res.* 27:376 (June) 1948, or Easlick, K., *Dental Caries*, St. Louis: The C. V. Mosby Company, 1948.

2. Lund, A. P., and Armstrong, W. D., Effect of a Low Calcium and Vitamin D Free Diet on the Skeleton and Teeth of Adult Rats. *J. D. Res.* 21:513 (Dec.) 1942.

3. Gaunt, W. E., and Irving, J. T., Influence of Dietary Calcium and Phosphorus Upon Tooth Formation. *J. Physiol.* 99:18 (Dec. 20) 1940.

4. Schour, I., Calcium Metabolism and Teeth. *J.A.M.A.* 110:870 (March 19) 1938.

5. Kronfeld, R., Calcium Metabolism and Teeth: A Summary of Present-Day Knowledge. *Illinois D. J.* 9:95 (March) 1940.

6. Robinson, H. B. G., Dental Caries and the Metabolism of Calcium. *J.A.D.A.* 30:357 (March 1) 1943.

7. Robinson, H. B. G., The Effect of Systemic Disease on the Caries Process—Pregnancy, Endocrinopathies, Osteomalacia, Emotional Disturbances, and Others. *J. D. Res.* 27:113 (Feb.) 1948.

8. Kitchin, P. C.; Sutton, T. S., and Edwards, L. F., Effect of Severe Calcium-Phosphorus Dietary Ratios and Repeated Pregnancy and Lactation on the Inorganic Content of Rat Teeth. *J. D. Res.* 27:728 (Dec.) 1948.

9. Albright, F.; Aub, J. C., and Bauer, W., Hyperparathyroidism: Common and Polymorphic Condition as Illustrated by 17 Proved Cases from One Clinic. *J.A.M.A.* 102:1276 (April 21) 1934.

10. Thoma, K. H., *Oral Pathology: A Histological, Roentgenological, and Clinical Study of the Diseases of the Teeth, Jaws, and Mouth*, ed. 2. St. Louis: The C. V. Mosby Company, 1944, p. 555.

11. Robinson, H. B. G., and Koch, W. E., Diagnosis of Cysts of the Jaw. *J. Missouri State D. A.* 21:187 (Oct.) 1941.

12. Schour, I.; Tweedy, W. R., and McJunkin, F. A., Effect of Single and Multiple Doses of Parathyroid Hormone on Calcification of Dentin of Rat Incisor. *Am. J. Path.* 10:321 (May) 1934.

13. Vanzant, F. R., and Phillips, J. R., Case of Hyperparathyroidism Associated With Extreme Dental Caries. *Am. J. Surg.* 50:130 (Oct.) 1940.

14. Armstrong, W. D., and Barnum, C. P., Concurrent Use of Radioisotopes of Calcium and Phosphorus in the Study of the Metabolism of Calcified Tissues. *J. Biol. Chem.* 172:199 (Jan.) 1948.

15. McCauley, H. B., Significance of Radioactive Isotopes in Dental Research. *J.A.D.A.* 29:1219 (July 1) 1942.

encouraging. Although some authorities have suggested that fluorine acts chiefly as a mineral by adding to the hardness or to the acid resistance of the complex ions of enamel, it is my opinion that its chief value is as an antibacterial agent or an antienzyme.

When the teeth have completed their eruption, they appear to have their mineral patterns established, and future mineral relations are unimportant for them. If there is any relation between the mineral content of the saliva and dental caries, it has not been demonstrated.

Role of the Vitamins

Vitamin therapy has proved of great value in combating scurvy, rickets, pellagra and other diseases caused by specific vitamin deficiencies. Unfortunately, when any such therapy has been discovered to produce seemingly miraculous cures in specific instances, that therapy is recommended indiscriminately by enthusiasts and the uninformed for conditions in which it has no general or specific value. It was only natural that dental caries should receive its share of vitamin therapy fired like broadsides at an unseen target. To many it never became apparent that a substance which promotes normal growth of a tissue may not be useful per se as a protector of that tissue against disease. Slowly the light has cast its gleam, leaving behind deluded dentists and physicians and their patients, who had hoped for protection but received none.

It has been shown that severe deficiencies of vitamin A produce abnormalities primarily in the enamel of developing teeth. Although the epithelial ameloblastic cells are affected first, there is a reflected defect in the dentin. In the experimental studies showing these changes, however, the vitamin A level was so low as to be almost incompatible with life.

Vitamin D, because of its antirachitic effects on bone tissue, has been the subject of much investigation designed to associate it with dental caries. Probably the best known work in this area was that of the Mellanbys.[16, 17] The early work of May Mellanby was on deficiency of both fat-soluble vitamins, A and D. It has been demonstrated that deficiency of vitamin D, probably with other factors, may result in the formation of hypoplastic or hypocalcified enamel. Whether or not hypoplastic enamel is more susceptible to caries than is normal enamel is a different matter. During developmental stages the dentin, as well as the enamel, is affected by vitamin D deficiency. The observation of Fish[18] that dietary excess of vitamin D and calcium can result in marked increase of calcium in the bone and serum but not in the dentin is significant. He extracted teeth from animals and analyzed blocks of dentin before he began experimental feeding. Prolonged feeding of a diet high in vitamin D and calcium practically doubled the calcium level of the serum, but dentin blocks from teeth diametrically opposed to those previously extracted showed differences well within the normal range of variation. Venar and Todd[19] emphasized another important point, that if sufficient calcium and vitamin D are present, additional amounts will not increase calcification.

Studies made on small population groups have been rather inconclusive. Mellanby's studies have been justifiably criticized because of the method of examination, because her studies disregarded the relative susceptibility of different teeth and because she confused caries and hypoplasia. While it is true that she referred to an almost micro-

16. Mellanby, H., The Effect of Maternal Dietary Deficiency of Vitamin A on Dental Tissues in Rats. *J. D. Res.* 20:489 (Oct.) 1941.

17. Medical Research Council, Committee for the Investigation of Dental Disease, *The Influence of Diet on Caries of Children's Teeth*. Medical Research Council, Special Report Series, No. 211. London: His Majesty's Stationery Office, 1936.

18. Fish, E. W., Effect of Vitamin D on Calcium Content of Dentine. *J. Physiol.* 84:272 (June 18) 1935.

19. Venar, Y. A., and Todd, T. W., Experiments on Maintenance of Mineral Density in Skeleton. *J. Lab. & Clin. Med.* 22:921 (Dec.) 1936.

Table 2.—Prevalence of caries and hypoplasia in relation to degree of clinical rickets[27]

Degree of clinical rickets	Boys examined	Teeth present	Total cavities	Cavities per mouth	Carious teeth, per cent	Boys with hypoplasia	
						Number	Per cent
None	113	3,019	172	1.52	5.69	76	67.26
Slight	64	1,782	109	1.70	6.12	40	62.50
Moderate to severe	23	656	32	1.39	4.88	14	60.87
Total	200	5,457	313	1.56	5.74	130	65.00

Table 3.—Comparison of caries prevalence in various groups

Locality	Children	Average age	Average cavities per mouth	Carious teeth, per cent	Caries-free children, per cent
Kangra Valley	200	14.33	1.56	5.74	49.00
Lahore City, India	756	13.58	5.74	17.66	5.95
Rochester, N. Y.	500	12.94	21.76	57.00	0.20

scopic hypoplasia rather than gross hypoplasia, the relation of this to caries has not been established. Bibby[20] and Anderson and his co-workers[21] claimed to have confirmed Mellanby's observation that the occurrence of microscopic hypoplasia and caries are directly correlated. Elliot and co-workers[22] found the incidence of hypoplasia of permanent teeth and the incidence of caries higher in rachitic than in nonrachitic children. On the other hand, Hess and Abramson[23] found caries less frequently in rachitic than in nonrachitic children; MacKay[24] found the same rate of caries attack in the two groups of children, with a higher incidence of hypoplasia in the former, and Brucker[25] observed no relation between caries and hypoplasia among 1,921 school children with 216 (0.7 per cent) hypoplastic teeth.

Most important was the work of Taylor and Day.[26, 27] In Rochester, N. Y., Day and Sedwick[28] had been unable to reduce caries occurrence by use of vitamin A and D supplements. In India, Day[27] found no increase in caries occurrence in 87 boys with clinical rickets, in comparison with 113 boys who had no clinical evidence of rickets (Table 2). Moreover, Indian children, in spite of marked rickets, have less caries than American children (Table 3). Why these poorly fed children should have so much less decay is worthy of extended consideration. Although they may have protective

20. Bibby, B. G., The Relationship Between Microscopic Hypoplasia (Mellanby) and Dental Caries. *J. D. Res.* 22:218 (June) 1943.

21. Anderson, P. G.; Williams, C. H. M.; Halderson, H.; Summerfeldt, C., and Agnew, R. G., The Influence of Vitamin D in the Prevention of Dental Caries. *J.A.D.A.* 21:1349 (Aug.) 1934.

22. Eliot, M. M.; Souther, S. P.; Anderson, B. G., and Arnim, S. S., Study of Teeth of Group of School Children Previously Examined for Rickets. *Am. J. Dis. Child.* 48:713 (Oct.) 1934.

23. Hess, A. F., and Abramson, H., The Etiology of Dental Caries. *D. Cosmos* 73:849 (Sept.) 1931.

24. MacKay, H. M. M., Vitamin D Deficiency, Dental Caries, and Tonsillar Enlargement: Clinical Investigation of Some Late Effects of Rickets. *Lancet* 2:1230 (Dec. 5) 1931.

25. Brucker, M., Studies on the Incidence and Cause of Dental Defects in Children: II. Hypoplasia. *J. D. Res.* 22:115 (April) 1943.

26. Taylor, G. F., and Day, C. D. M., Osteomalacia and Dental Caries. *Brit. M. J.* 2:221 (Aug. 17) 1940.

27. Day, C. D. M., Nutritional Deficiencies and Dental Caries in Northern India. *Brit. D. J.* 76:115 (March 3), 76:143 (March 17) 1944.

28. Day, C. D. M., and Sedwick, H. J., Fat-Soluble Vitamins and Dental Caries in Children. *J. Nutrition* 8:309 (Sept.) 1934.

factors which control caries, the important point in this consideration is that caries is controlled to a greater extent in India than in America despite a diet that admittedly is grossly deficient.

Howe[29, 30] demonstrated that vitamin C is an important factor in the growth of dentin. Scurvy, rather than decay, was produced in animals fed a diet low in ascorbic acid. Hanke[31] studied 323 children in an orphanage, and reported about 50 per cent reduction in tooth decay among those given a supplement of 1 pint of orange juice daily. However, children receiving 3 ounces of the juice (about 50 mg. of ascorbic acid) daily had more caries than the controls. Grandison, Cruickshank and Stott[32] reported no caries inhibition in children given supplements of 200 mg. of ascorbic acid daily.

Vitamin B complex factors do not appear to play any significant role in caries. Mann and co-workers[33] reported less caries in 124 malnourished patients than in 99 patients free from nutritional deficiency diseases.

Teeth formed during a period of vitamin deficiency are more likely than others to be hypoplastic or hypocalcified, but whether increased susceptibility to caries results has not been clearly demonstrated. If the intake of vitamin D is adequate during tooth development, supplemental dosage does not appear to have any logical or demonstrated value in prevention of future caries. Vitamin D supplements do not offer any beneficial effect in retarding the initiation or progress of decay in erupted teeth. The use of other vitamins for caries control has an even more tenuous basis.

Systemic Conditions

The great confusion in the relation between systemic conditions and dental caries is due to the acceptance of unfounded statements of individuals who have not subjected their data to scrutiny by scientific methods. Of course, caries develops in patients with tuberculosis, cancer, diabetes, psychoses and nutritional deficiencies, just as it does in their healthier fellows. Caries remains a universal disease, striking the halt and the blind as well as healthy athletes and beauty queens.

Pregnancy and lactation are two systemic conditions which traditionally have been held guilty of promoting caries. Ziskin and Hotelling,[34] Starobinsky[35] and Mull, Bill and Kinney[36] showed the fallacy of this myth by conducting careful statistical analyses. Also, Schour,[4] Robinson,[6, 7] Burket,[37] Deakins and Looby[38] and Klein[39] have shown that pregnancy and lactation per se are not causes of dental caries. Dentists should say goodbye to a favorite myth, and insist that women take acceptable precautions against caries during pregnancy and lactation as during other periods of life.

Diabetes mellitus may have increased the activity of dental caries before insulin was discovered. Since diabetes has been controllable by medical therapy no adequate studies of caries activity in diabetes

29. Howe, P. R., An Account of Progress in Dental Dietetic Research. *D. Cosmos* 68:33 (Jan.) 1926.

30. Howe, P. R., Studies of Dental Disorders Following Experimental Feeding With Monkeys. *J.A.D.A.* 11:1149 (Dec.) 1924.

31. Hanke, M. T., *Diet and Dental Health*. Chicago: University of Chicago Press, 1934.

32. Grandison, W. B.; Cruickshank, D. B., and Stott, L. B., Investigation Into the Influence of Synthetic Vitamin C as a Controlling Factor in the Incidence of Dental Caries in Already Calcified Teeth. *Brit. D. J.* 72:237 (May 15) 1942.

33. Mann, A. W.; Dreizen, S.; Spies, T. D., and Hunt, F. M., A Comparison of Dental Caries Activity in Malnourished and Well-Nourished Patients. *J.A.D.A.* 34:244 (Feb. 15) 1947.

34. Ziskin, D. E., and Hotelling, H., Effects of Pregnancy, Mouth Acidity, and Age on Dental Caries. *J. D. Res.* 16:507 (Dec.) 1937.

35. Starobinsky, I., Beobachtungen über Zahncaries bei Schwangeren und die Wasserstoffionenkonzentration in ihrem Speichel. *Deutsche Monatschr. f. Zahnh.* 47: 238 (March 1) 1929.

36. Mull, J. W.; Bill, A. H., and Kinney, F. M., Variations of Serum Calcium and Phosphorus During Pregnancy: Effect on Occurrence of Dental Caries. *Am. J. Obst. & Gynec.* 27:679 (May) 1934.

37. Burket, L. W., *Oral Medicine: Diagnosis, Treatment*. Philadelphia: J. B. Lippincott Company, 1946.

38. Deakins, M., and Looby, J., Effect of Pregnancy on Mineral Content of Dentin of Human Teeth. *Am. J. Obst. & Gynec.* 46:265 (Aug.) 1943.

39. Klein, H., The Effects of Pregnancy on the Incidence of Tooth Decay. *D. Cosmos* 77:864 (Sept.) 1935.

under various degrees of control has been made. Studies of caries in patients whose diabetes is controlled are studies of caries not in diabetic persons but in treated persons.[40-42] It is possible that reduced salivary flow may have a local environmental effect when diabetes is uncontrolled, but this question requires study.

Patients with tuberculosis have dental caries—as might be expected, since persons without tuberculosis also have caries. The studies of Tanchester and Sorrin[44] and of Broderick[45] failed to show increased caries in victims of the disease. Tanchester and Sorrin[44] and Miller[46] reported decalcification in patients with tuberculosis who used acidulated lozenges to relieve dryness of the mouth. Here the lozenges themselves and possibly the xerostomia probably had more effect than the disease.

No causal relation has been established between dental caries and endocrine disease.

Studies of the relation between acute infectious diseases and dental caries are difficult because the acute diseases are of short duration, and caries develops slowly. Patients often date the beginning of rampant caries to the period following an acute infectious disease, but since systemic diseases of this type are more prevalent in childhood and dental caries is most active at this time, the cause and effect relation is questionable. Too much *post hoc, ergo propter hoc* thinking is used in drawing these conclusions. Acute infectious disease and dental caries both are too widespread to permit valid comparisons of this type.

Psychic trauma has been suggested by Briggs,[47] Barrett[48] and others as a probable cause of dental caries. No data have been presented to substantiate these claims, although psychic reactions may lower salivary flow and contribute to decrease in local environmental resistance to caries. Since 75 per cent of the population is said to be suffering from some nervous disorder or emotional conflict, however, the problem of universality again enters.

The nutritional state has been discussed specifically in the sections on minerals and vitamins. Reports from war-torn countries have indicated a reduction in caries activity among persons on relatively deficient diets. Taylor and Day's[26, 27] studies in India substantiated the idea that inadequate nutrition is more likely to reduce than to accelerate caries activity. The observations of Mann and others,[23] who found 30.5 per cent less caries in malnourished than in well nourished patients, should be considered. Since the bacteria that contribute to caries live outside the body and in the food which passes through the mouth, it is obvious that nutrition inadequate for the human being may be inadequate for the incidental occupants of his oral cavity.

Hurme[49] made an effort to correlate dental caries activity with general health, but found no significant relation. Although he showed differences of 2.7 carious teeth between his 10 healthiest and 10 sickliest subjects, it is doubtful if these differences are beyond the limits of pure chance. Cunningham[50] found no reliable relation between caries and physical status in 11,117 young women. Certainly,

40. Cohen, M. M., Clinical Studies of Dental Caries Susceptibility in Young Diabetics. *J.A.D.A.* 34:239 (Feb. 15) 1947.

41. Lederer, W. J., cited by Cohen.[40]

42. Grunert, A., cited by Cohen.[40]

43. Magitot, E., cited by Cohen.[40]

44. Tanchester, D., and Sorrin, S., Dental Lesions in Relation to Pulmonary Tuberculosis. *J. D. Res.* 16:69 (Feb.) 1937.

45. Broderick, F. W., *The Principles of Dental Medicine: The Medical Aspects of Dental Disease*, ed. 3. St. Louis: The C. V. Mosby Company, 1939, pp. 476 and 480.

46. Miller, S. C., Generalized Decalcification of Unusual Etiology. *New York J. D.* 4:230 (July-Aug.) 1934.

47. Briggs, E. F., Psychogenic Factor in Dental Caries. *D. Digest* 50:115 (March) 1944.

48. Barrett, L. G., Evaluation Disorders and Caries—Semantogenic Symptoms. *J.A.D.A.* 26:1819 (Nov.) 1939.

49. Hurme, V. O., Relation of Dental Caries to Health History, Physical Measurements and Heredity. *J. D. Res.* 15:395 (Dec.) 1936.

50. Cunningham, R. L., Relation of Dental Caries to Disease, Menstrual Experience, and Physical Measurements of Young Women. *J. D. Res.* 14:439 (Dec.) 1934.

the fact that dental chairs are not occupied by the weak and the sick but by a general cross section of the population is significant.

Heredity can be a factor in rat caries, as demonstrated by Hunt, Hoppert and Erwin,[51] but in modern man genetic backgrounds are well mixed. Although heredity may influence the form, composition and position of teeth and the salivary condition, in man environmental factors overshadow hereditary patterns.

Summary

Dental caries activity may be influenced through its etiologic factors. These may be considered in tabular form (Table 1).

From the foregoing analysis it becomes obvious that dental caries is different from other bacterial diseases because the organisms concerned do not live on tissues and tissue fluids but on food of the same general character as that consumed by their host. They utilize this in the oral environment, outside the body, and are influenced by changes in that environment. Proper vitamin and mineral intake and a good general physical state are important in development of good teeth in good position, but once those teeth are formed, few bodily conditions can influence them.

Good nutrition is important for general well-being and health, but neither good nutrition nor freedom from systemic disease offers any substantial assistance in prevention of dental caries.

51. Hunt, H. R.; Hoppert, C. A., and Erwin, W. G., Inheritance of Susceptibility to Caries in Albino Rats (Mus Norvegicus). *J. D. Res.* 23:385 (Oct.) 1944.

PROVISIONS FOR DENTAL TREATMENT IN FINLAND: A REVIEW

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FINLAND has no general, official program of dental treatment. Instead, most adult patients are treated by private dentists in their offices. There are, however, publicly supported programs for school children, and a few communities furnish dental care to adults.

At the beginning of the current century a dentist in Helsinki gave treatment to primary school children free of charge. A few years later, on the proposal of this dentist, the city of Helsinki founded a small clinic in which the teeth of primary school children were treated. Now the city has a central clinic and several branch clinics. Gradually the other large cities began to found similar clinics, the dentists usually taking the initiative in their establishment. Since the Finnish Dental Association was organized in 1924, it also has made proposals to cities and rural communities for founding school clinics in which the teeth of school children can be taken care of at the expense of the communities. The communities were, at least in the beginning, reluctant

President of the Finnish Dental Association.

to agree to such proposals, for fear of great expense.

The share of General Mannerheim's Child Welfare Association in this work deserves mention. This association has promoted the cause through propaganda and supplied funds for school clinics in many communities for several years. Since the importance and vast extent of the matter was thus impressed on the minds of the community authorities, the state of things has improved remarkably during recent years. At present there are approximately 350 community school dental clinics, and only 217 communities are without them. It is certain that the great economic sacrifice demanded of the communities by war has resulted in the slow development of this activity. At present, only the smallest, most sparsely populated communities have no school dentist.

Both the state and the communities bear the expenses of school dental treatment. The state pays the rural communities two thirds of all expenses, whereas the cities get a fixed sum annually, from which other school expenses also must be paid, so that the proportion allotted to dental treatment cannot be accurately given.

In school dental clinics all kinds of treatment are given to primary school children, that is, children between 7 and 14 years. In some large cities kindergarten children and those who have left the primary schools for industrial schools also are treated. Treatment which is partly voluntary is given to pupils in secondary schools in some cities, for example, Helsinki. The pupils are treated at the clinics, but they must pay 100 marks (about 65 cents) a year for all the treatment they receive.

Adults do not get dental treatment at the expense of the state except in approximately six communities that have a community dentist. The state pays a small sum annually toward his upkeep, but most of his salary is paid by the community. The services of the community dentist are available only to adults without any means. Only poor persons are given treatment in outpatient clinics of hospitals, chiefly for toothache. Hence, the question of treatment of persons with some means does not arise.

School Dental Plan

The dental treatment of school children takes place in the clinics founded by the communities. They have, in general, modern equipment and the services of a dental nurse. In small communities where there are not so many children in need of treatment that it would pay the community to found a clinic, the treatment is given in the private office of the school dentist. In either the clinic or the dentist's private office, treatment is given only by dentists. The clinic dentists have an annual salary. They usually work either three or six hours a day, which corresponds to six hundred or twelve hundred hours a year.

In some communities there is only enough school dental work in the beginning to keep the dentist busy one or two hours a day. Therefore the salary is computed by the hour, and the number of hours increases as necessary. The annual salary for one hour's work a day is 66,000 marks ($424.25); for two hours, 132,000 ($848.50); for three hours, 191,400 ($1,210.32); for four hours, 237,600 ($1,527.29); for five hours, 283,800 ($1,824.27), and for six hours, 330,000 ($2,121.24). Owing to the price and salary regulations, present salaries remain somewhat below the proper salaries calculated according to the index.

When a dentist works in his own office, the fee is fixed according to the number of teeth treated and the kind of treatment. The dentist is allowed to add 20 per cent to the bill for office rent, instruments and materials. Both the annual salaries and the rates per tooth have been raised, with the development of inflation,

according to the proposal made by the Finnish Dental Association to the price and salary section of the Ministry of Supply, where new rates were fixed through negotiations. In all the school dental clinics in the country the annual salaries and rates are the same.

In Helsinki in 1948 the treatment was calculated to cost 350 marks ($2.25) per pupil. The amortization of the cost of founding the clinic was not included in this sum.

Industrial Dentistry

Some large firms and industrial establishments have begun to pay for the dental treatment of their workers. Some firms have founded free dental clinics of their own. These usually are located in the building where the workers are employed and are staffed by dentists with an annual salary about 10 per cent higher than those in school clinics. Other firms pay all or part of the cost of treatment by dentists that the workers themselves choose or by a dentist named by the firm. These arrangements have been made voluntarily by the firms as additional compensation for the workers.

Dental Practice Regulation

Representatives of the dental profession were consulted before passage of the law concerning dental practice which was issued on May 18, 1934, and took effect on June 1, 1934. Paragraph 7 of the law laid down a penalty for persons who practice dentistry without a permit. Provisions of the law were made more definite in the regulation of September 27, 1935. This regulation granted dental technicians the right to repair prostheses when it is not necessary to take an impression, place prostheses in the mouth or otherwise handle the patient personally. It may be seen that in Finland dental laboratory technicians have not the right to do the work of a dentist.

National Dental Proposal

Approximately a year ago a state committee was appointed to prepare a proposal for national dental treatment at the expense of the state. The proposal of the committee will soon be completed, but owing to the wide extent of the problem and the great expense involved, there apparently is little possibility of realizing it in the near future. Moreover, the dental profession of the country, which comprises about 1,200 members, would not be able to meet so great a demand as national dental treatment would require.

Dentists in general are satisfied with the present arrangement. The fees of a school dentist are small in comparison to what private practice may bring if the dentist has a large number of patients and works energetically. But the school dental positions are in great demand, since they provide a reliable income and have other advantages, such as a three months' summer vacation and a pension. The general attitude of the public is that clinics supported at least partly by the state, in which people with a small salary could get treatment, are badly needed.

THE SWEDISH NATIONAL DENTAL PROGRAM

Axel Kjellberg, Stockholm, Sweden

DENTISTS in Sweden realized early that a public dental service was necessary if large sections of the population were not to be deprived, mainly for economic reasons, of dental treatment. Through educational work and pressure on government authorities, they aroused public interest, and in 1904 the question of establishing a public dental service was put before Parliament. The proposal was defeated, however. In 1912, the Swedish Dental Federation appealed to His Majesty the King for a statement on the matter, but it was not until 1938 that Parliament decided to establish a public dental service.

In the meantime, however, dentists and local authorities had begun to arrange for dental service at schools and in many hospitals, institutions for the disabled and prisons. By 1938, dental care was provided in the government schools of most towns and many rural communities.

The public dental service law came into force Jan. 1, 1939. Its aim is to offer at a reasonable price to children and adults the possibility of maintaining and promoting the efficiency of the teeth as masticating organs and of preserving the teeth and oral cavity in healthy condition, so that they do not become a source of infection to the organism as a whole. Dental care comprises complete conservative care of the oral cavity, including restitution of lost teeth when this is necessary for the efficiency of the chewing apparatus.

The dental service established by the state in principle is open to every citizen, but is based on dental care in schools. The school dental service established previously by individual communities is to be taken over by the public dental service as this is enlarged.

Organization

Sweden is divided into 25 county council districts, with a certain amount of self administration by county councils. These county councils administer the public dental service, which thus is no state institution. The six largest cities of the country are outside the jurisdiction of the county councils, and are to organize public dental service for themselves. Within each county there are varying numbers of towns and villages, also with their own administration.

The counties are divided into dental care districts, each with a so-called district dental polyclinic with one or more dentists. Of the working time of each dentist, one thousand hours are allocated to children and nine hundred hours to adults. It was calculated that the dentist should be able to give full treatment to 800 children in this time, but owing to the high frequency of dental decay, this figure had to be decreased to 600. One dental nurse is employed for each dentist. Dental laboratory technicians are employed according to demand, and commercial dental technical firms also are used.

In districts employing several dentists, a division of labor sometimes is re-

Secretary, Swedish Dental Federation.

sorted to, with certain dentists working only with children and others treating adult patients exclusively.

Within each county council district and each city outside the county is a so-called central dental polyclinic, attached to the county central hospital. This is meant partly for patients with complicated conditions which cannot be dealt with conveniently by the district dental clinics, partly for hospital patients and partly for general public dental care.

Besides the care offered by the district dental clinics and the central dental polyclinics, the so-called institutional dental service in hospitals, mental hospitals, sanatoriums and prisons falls under the public dental service. The organization of this has had to be postponed, owing to lack of dentists, among other things, but eventually will be taken in hand.

Schedule of fees for adults

	Swedish crowns	Equivalent U. S. dollars
Roentgenogram		
One tooth	3	0.83
Each further tooth at same visit	1	0.28
Extraction		
One tooth under local anesthetic	3	0.83
Each further tooth at same visit	1	0.28
Amalgam filling, simple	4	1.11
Amalgam crown	10	2.78
Silicate filling	5	1.39
Gold crown	40-50	11.13-13.91
Richmond crown	40	11.13
Root canal filling	7	1.95
Local anesthetic	1	0.28
Complete dentures		
Vulcanite, one jaw	40	11.13
Vulcanite, both jaws	70	19.48
Synthetic resin, both jaws	100	27.83

Personnel

To qualify for dental service within the public service, the dentist must have passed the Swedish dentists' examination and hold the certificate issued by the Royal Medical Board. All treatment is referred to qualified dentists. A dentist employed in the public dental service is not permitted to carry on private practice. The dental nurse assists the dentist and looks after apparatus and instruments; she does not administer any treatment. The work of the dental laboratory technician is restricted to the laboratory.

At present, state colleges train dental nurses and dental laboratory technicians, and the Royal Medical Board issues certificates of competence, which qualify them for office in the public dental service. During the transition period, dispensations may be granted. There are no dental hygienists in Sweden.

Distribution of Care

Preschool children above 3 years and school children up to 15 receive initial complete treatment and an inspection thereafter at least once a year. School children are called up for these treatments, but attendance is not compulsory. Nearly 100 per cent of school children register voluntarily.

Persons between 15 and 19 who have received school dental care and have been present for treatment at least once a year are entitled to treatment at a reduction of 25 per cent on the adult rate (table). They come for treatment on their own initiative.

The working hours that remain in the clinics are devoted to dental care for adults. For these, too, treatment is as

nearly complete as possible. Naturally children, young persons and adults are treated also for acute conditions. The present plan for public dental care does not aim at treatment for all adult patients who wish it, although public dental care does in principle extend to all citizens without regard to economic condition. Destitute and underprivileged persons may receive dental treatment at communal expense, to the cost of which the state contributes a part (50 per cent, according to the new proposal). Funds allocated to dental care are not considered poor relief.

The highest supervisory authority for public dental service is the Royal Medical Board. It has the right, among other things, to approve the dental service plans of the county councils, to make recommendations to His Majesty the King for the post of superintendent of the central dental polyclinic and to appoint inspectors and other officials.

The dental inspector in each county and each city outside the county assists the council's administrative committee for the organization of public dental service within the area and suggests appointments for district dental posts.

Distribution of Cost

Each county council is responsible for the costs of public dental service within its area. The state contributes 3,000 crowns ($835) for the equipment of each district dental clinic and, if more than one dentist is employed, 1,300 crowns ($360) for each additional dentist. Moreover, the state makes a salary contribution of 3,000 crowns ($835) for each district dentist and 1,000 crowns ($280) for each dental nurse. Fixed age supplements also come from state resources. No state contribution is made toward the organization or management of central dental polyclinics.

The county councils have other sources of income as well, however; namely, fees for treatment received by children and compensation at a special rate for dental service received by adult patients.

For the treatment received by children between 3 and 15, the guardians are supposed to pay 5 crowns ($1.39) per year for the first child, 3 crowns (83 cents) for the second and 2 crowns (56 cents) for the third in the same family treated simultaneously. No fee is charged for further children in the same family receiving treatment at the same time. A large number of towns and villages, however, have decided to pay these fees. Young persons (15 to 19) pay the adult rate with a reduction of 25 per cent.

All dental treatment other than the aforementioned is rendered in return for a fee fixed by the government. The rate for treatment of complicated dental defects, which is given at the central dental polyclinic, is fixed by the county council. In principle the rates for public dental service are to cover the costs of dental treatment for adults. The cost of establishing and equipping polyclinics and the sick benefits and pensions of district dentists, nurses and dental laboratory technicians are not allowed for, however. The program, therefore, is far from self supporting. The fees (table) are not sufficient for financing the public dental service. The deficit is made up from taxes.

In 1947, the cost of public dental service was 13,619,157 crowns ($3,790,211.39). Fully 550 district dentists were employed. Systematic dental care was furnished to 205,000 children between 3 and 15 and emergency relief to about 30,000. Approximately 70,000 adults had complete dental treatment, and about 95,000 visited the clinics for acute troubles only.

Dentists' Income

The dentists' remuneration is regulated according to an agreement between the Swedish Dental Federation and the

county councils. It is payable partly as fixed salary and partly as commission on the gross amount of dental care furnished adults. Conditions have improved gradually, and the income of district dentists now is between 14,000 and 18,000 crowns ($4,000 and $5,000) per year, depending on the locality. If sick insurance and pensions are taken into consideration, the income of publicly employed dentists is higher than that of those who practice privately.

With regard to the patient's choice of a dentist, persons residing in a dental care district are directed to the district dental clinic and to the dentist employed there. If there are several dentists, patients are divided among these by the superintendent of the clinic, the patient's wishes being taken into consideration if possible.

The dental profession was represented in all expert discussions preceding the parliamentary decision to establish a public dental service, and it had the opportunity to put forward its point of view in declarations. Many proposals received attention; others did not.

Defects in Program

The original plans for public dental service had certain shortcomings, which became manifest during the ten years of operation. It has not been possible to carry out public dental service with the speed anticipated. Because of a serious shortage of dentists[1] and recruiting difficulties, district dental service has been only about 40 per cent active, although it was expected originally that the scheme would be in full operation by 1947. The lack of dentists was accentuated during the war, when dentists of military age generally had to serve in the armed forces for about a year. At present, facilities for training dentists have been appreciably increased through establishment of a dental college.

Difficulties in filling vacancies in the district dental service led the authorities to a serious mistake. In 1943 a law was passed which required of every newly qualified dentist one year in the public dental service before he could receive his certificate. One of the reasons given for the law was that young dentists should have an opportunity for further training, but most of them had to carry out their service in one man polyclinics, in which it was difficult to provide a staff. In reality the law was merely enforcement of labor, a classic example of the temptation of even democratic states to restrict the freedom of the individual. Its compulsory nature aroused public indignation. Supported by other academic organizations, the Swedish Dental Federation succeeded in 1948 in preventing continuance of the law by supplying voluntary labor for a year.

This law had serious psychologic consequences and has contributed to a large degree to the repugnance of dentists toward work in the public dental service. Other causes for this have been the strictly fixed hours of work, the restricted possibilities for promotion, and red tape. On the other hand, many dentists are attracted by the security and regularity of working conditions within the public dental service.

Public dental service has promised more in theory than it could offer in practice. The growing numbers of children made it difficult to cope with preschool and school dental care. Often, too, the results achieved by treatment have been spoiled through failure of young persons to continue dental care after it was free no longer. Also, the great demand for dental care for adults led to an accumulation of applications for treatment, so that long periods of waiting, disastrous for dental conditions, were inevitable.

1. There are about 3,000 dentists, one to about 2,250 inhabitants of Sweden.

Outlook for the Future

The experience gathered in the past years has led to a demand for revision of the current scheme. Six experts, three of them publicly employed dentists, were appointed by the government to study the problem. They have put forward proposals for certain alterations, the most important of which follow:

The size of the districts should be decreased. The number of dentists needed in public dental service is now calculated to be between 2,000 and 2,500, as against the 1,200 estimated by the old plans. A state contribution of 16 crowns ($4.45) should be made toward the treatment only of children and adolescents receiving systematic care. The communities, instead of the guardians, should pay the fees for school children. Adolescents between 16 and 19 should receive systematic dental care for a fixed price of 6 crowns ($1.67) per year, which should be paid by the communities to the county councils. District dentists should devote 60 or 70 per cent of their time to children and adolescents and 30 or 40 per cent to adults.

A new type of post should be created, especially meant for school dentists and providing a working time of one thousand three hundred hours during the school terms. Furthermore, there should be a number of supervisory posts, which would increase the possibilities for promotion.

The experts proposed also an increase in fees, not so great, however, that dental care for adults would be self supporting.

Although the recommendations incorporated many of the wishes of the dental body, the federation has pressed for even more radical alterations in the public dental service. It strongly pointed out that treatment of children and adolescents should receive priority, even at the expense of dental care for adults. As the time set aside for care of adults is certainly insufficient if the principle "open to all' is to be applied, the organization advised that preference be given to destitute and underprivileged patients.

It urged, further, that part time posts be established and that holders have the right to private practice besides. It recommended that private dentists be called on to the largest possible extent for dental care at hospitals and other institutions. It stressed the demand that district dentists enlighten the public about prevention of dental diseases, which has not been done in the public dental service.

In spite of its critical attitude toward the public dental service in fundamental points, the dental body now, as always, fully supports the principle.

Outside the public dental service there is still room for much individual dental work, which dentists definitely consider desirable. A movement toward complete socialization of dental care, therefore, should certainly meet strong opposition from dentists.

Despite dissatisfaction with such defects as the long periods of waiting, the public's interest and confidence in public dental service has been great. The almost 100 per cent membership of children in the school dental service and the queues of adult patients show this. The equipment of the polyclinics is of first class and the treatment of good quality. The Swedish public dental service must therefore be considered a significant and valuable factor in the health care of the nation.

COMBINED ROOT CANAL THERAPY AND APICOECTOMY: A PROGRESS REPORT

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THE theory that pulpless teeth, if adequately treated, may remain in function for an indefinite period without being in any way a menace to the health of the patient is supported by a series of 30 cases in which a method of root canal therapy was combined with apical root resection. The technic was patterned after that of the late Albin Oppenheim, M.D., research professor in orthodontics at the School of Dentistry, University of Southern California. Cases have been observed for as long as six years, and there has been no occasion to remove any of the treated teeth. This favorable response no doubt was considerably influenced by the care exercised in selecting cases.

Thorough and adequate treatment must be instituted in order to insure the success of the procedure. The technic herein presented, of combining the cleansing and filling of the root canal with surgical elimination of the involved root apex and periapical tissues in one operation, offers a way of eliminating infection and retaining teeth which otherwise might not present a favorable prognosis for root canal treatment. Such conditions as extensive periapical radiolucency and curved root ends may be successfully handled, whereas nonsurgical treatment might not eliminate infection from the periapical area.

Selection of Cases

Only when the prognosis for retention of a nonvital tooth is favorable should the method be used. The decision to retain and treat teeth is based on the established principles of root canal therapy. Such general factors as the value of the involved tooth from the developmental, functional, esthetic and restorative points of view and the health, age and attitude of the patient are to be considered. Particular emphasis should be placed on the following factors:

1. Accessibility of the Tooth.—For adequate access to the apical area, the lip must be flexible enough and the mucobuccal and the mucolabial sulcus sufficiently deep for good flap retraction. When teeth have excessively long roots or when the lip attachment is close to the gingival margin, surgical procedures are difficult. In general, maxillary anterior teeth provide the best accessibility. A few mandibular anterior teeth, two mandibular bicuspids and one maxillary bicuspid were treated in this series. In treatment of a maxillary bicuspid the proximity of the apex to the maxillary sinus may complicate the operation. When a mandibular bicuspid is involved, the relation to the mental foramen must be considered. Temporary or even permanent paresthesia of the lip may result from interference with the mental nerve emerging from the mental foramen. In the 2 cases in this series in which a lower bicuspid was treated, normal sensation

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returned to the lip in one month after the operation.

2. ***Proximity of Adjacent Teeth.***—The roots of adjacent teeth should be sufficiently distant from the involved area so that there is no danger of injury to them during operation. It is conceivable that repair tissue might replace damaged periodontal membrane on the side of an otherwise normal tooth, but so far there is no evidence to substantiate this suggestion. This complication usually can be predicted after proper presurgical roentgenographic study.

3. ***Extent of Involvement of Periodontal Membrane.***—For the purpose of this study, periodontal membrane is considered healthy when, as nearly as can be determined by roentgenographic and clinical observation, it has retained its normal relation to the alveolar bone and the cementum. This assumes that the alveolar bone and cementum also are normal.

The success of the operation is predicated on the removal of that portion of the root of the tooth which is deprived of its periodontal membrane attachment to the lamina dura. If more than half of the root is deprived of its attachment, apicoectomy is probably contraindicated because, although the operation itself might be successfully performed, the amount of alveolar support of such a tooth is so reduced and its resistance to stresses so impaired as to make its value questionable. It should be evident that periodontal involvement from the gingival as well as from the apical direction must be taken into account. Removal of that portion of the root which is involved in the destruction of the periodontal membrane is a basic premise of the technic.

It is difficult, if not impossible, to remove thoroughly by curettage the necrotic bone and granulomatous material that lies behind the projecting root end in an abscessed region. In addition, this denuded root end, with its covering of nonvital cementum, is in the nature of a foreign body irritant and may act as a deterrent to proper healing.

Experience has shown that when the tooth or teeth have become nonvital as the result of trauma, the injury probably was of sufficient magnitude to result in resorption of a large part or all of the alveolar plate over the labial surface of the root. The root is to be resected to the point where it is protected by healthy alveolar bone. If the entire labial plate is gone there is no place to stop and the tooth must be lost. Unfortunately this condition cannot be visualized in the roentgenogram and is discovered only on elevation of the mucoperiosteal flap. History of trauma to the tooth must, therefore, be considered a possible contraindication to apicoectomy.

In cases of fistula, particularly if the opening is near the gingival border, the alveolar plate is often so involved that it offers no appreciable support for the tooth if the root is amputated beyond the point where the labial bone remains intact. The extent of this involvement often is not detectable by roentgenographic examination. Therefore the presence of a fistula, particularly if it opens toward the gingival crest and is of long standing, must be considered as another probable contraindication to apicoectomy.

4. ***Extent of Bone Involvement.***—The cavity within the bone resulting from curettage of all pathologic tissue and removal of the root end must not be too large to allow immediate closing of the overlying mucoperiosteal flap with expectation of blood clot formation and organization within the bony defect. In any cavity so large as to require postoperative drainage, the danger of reinfection of the periodontal membrane of the retained tooth is too great for this method of treatment to be advisable.

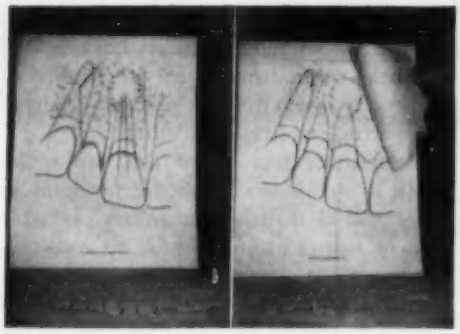

Fig. 1.—Left: Incision for flap. Right: Flap elevated

Method

Following is an outline of the technic:

1. The patient is given ¾ to 1½ grains (0.049 to 0.097 Gm.) "Seconal Sodium" or pentobarbital sodium about twenty minutes before operation.

2. The operation can be performed with either general or local anesthesia. Local anesthesia was used in all cases in this series. Two per cent procaine hydrochloride or 1 per cent butethamine ("Monocaine") hydrochloride solution has given satisfactory anesthesia in some cases, but the presence of less readily anesthetized infected tissue is a probable indication for stronger solutions, such as 4 per cent procaine hydrochloride or 1½ per cent butethamine hydrochloride.

3. During induction of anesthesia the crown of the tooth is opened, either through the existing cavity or filling or through a new direct opening. Access to the pulp chamber and conservation of tooth structure are the factors to be considered. The pulp is, of course, nonvital, and time is saved by making the opening immediately. The entire pulp chamber and root canal are thoroughly opened and all contents are removed.

4. By the time this is completed the tissues are anesthetized, and the operator proceeds to lay the flap. The incision usually consists of one straight cut from the mucobuccal fold to the gingival margin, paralleling the root of the tooth but at a slight angle in order to have the mucobuccal end of the incision approximately over the apex of the adjacent tooth (Fig. 1). When elevated, this flap gives good access, and the incision heals without scarring. Neither of these results was always obtained with the usual horizontal incision. The incision line should be far enough from the tooth involved to insure readaptation of the flap to healthy bone. No difficulty has been experienced with reattachment of detached gingival tissue to the neck of the tooth.

5. Often, on retraction of the flap, the labial plate is found to be destroyed over the apex of the root. This simplifies matters, but if the bone is intact an opening is made with chisels or bone bur. Care must be exercised to open over the apex of the proper tooth, since the apex of the root is sometimes not exactly where one might expect and a slight error in calculation might involve the adjacent tooth.

6. As soon as the root is identified, the window is made sufficiently large to insure adequate removal of the granulomatous material or cystic membrane present. Enough of this material is removed with curets to isolate the root end and insure its remaining dry during the filling process. The root tip is not resected at this time. If hemorrhage or serous exudation interferes with dryness of the root end, 1:1,000 epinephrine solution is applied for a minute on a cotton pellet.

7. The root canal, which was opened previously, is irrigated with physiologic solution of sodium chloride by means of a Luer glass syringe fitted with a blunt needle. The assistant aspirates the injected solution, or it may be absorbed on cotton rolls. The canal is easily cleansed in this way of all blood and loose debris.

8. The canal, now washed clean, is dried with a blast of warm air or absorbent points. A gutta percha point is

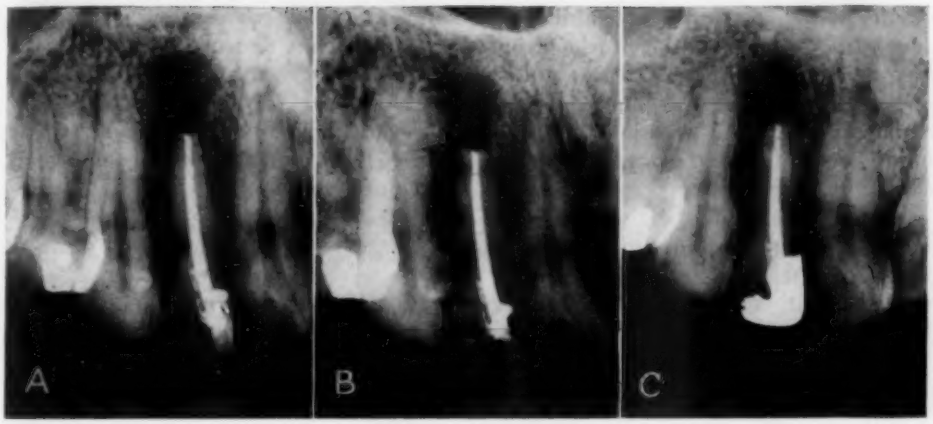

Fig. 2 (Case 1).—Roentgenograms made (A) May 12, 1946, (B) June 5, 1946, and (C) July 17, 1947, showing results of treatment in a man aged 26 years

selected. It must be of such size that it can be seen projecting out of the apical end of the root canal and so strong that it will not bend or collapse when it is used for the final filling. This is now sterilized and laid aside in a convenient place.

9. The canal is now dry, and it should be sterilized with 95 per cent phenol followed with alcohol. A "Jiffy" tube is selected which will fit the opening in the crown of the tooth. It is well to be sure the apex of the root is still dry, and the canal is dried again with a blast of air or absorbent points.

10. Crown and bridge cement is now mixed, placed in the "Jiffy" tube and injected into the root canal. The cement is squeezed into the tooth until it comes out through the apex. The gutta percha point which was previously fitted is inserted until it projects through the cement at the apex.

11. The apical area is kept dry until the cement is set. The excess cement then can be flaked away with a curet; the gutta percha usually will break off even with the apex.

12. The denuded root end is now ready to be amputated. This is done with a chisel and mallet or with a fissure bur. All root structure involved in the diseased area is to be removed. The extent to which this involvement has progressed coronally along the root is determined by a study of the roentgenograms and by exploration. The root may be cut diagonally if the periodontal membrane is involved more extensively on one side of the tooth than on the other.

13. After the root end is amputated, the abscessed region is thoroughly curetted until a clean bony wall is left. A thin layer of sulfathiazole powder is insufflated into the defect, and the flap is sutured into place.

14. Roentgenograms should be made at this point. If the technic has been followed carefully, the canal will be completely filled. If the roentgenogram indicates an apparent shortness of the root canal filling at the apex, it is due to the fact that the plane of cutting of the root end is different from the angle of incidence of the roentgen rays.

15. Ice packs and postmedication are prescribed. Usually acetylsalicylic acid, 5 or 10 grains (0.324 or 0.648 Gm.), will relieve pain. Physiologic solution of sodium chloride should be used as a

mouth wash, and care in brushing is advised. Diet need not be restricted but the patient should be cautioned not to disturb the tissue flap. Some swelling is to be expected, and occasionally ecchymosis occurs inside the lip and on the cheek. On one or two occasions ecchymosis extended to the lower orbital border. Though alarming to the patient, this is not serious. Sutures usually are removed in three or four days.

Report of Cases

The experience in these cases dates from 1941. The technic has been essentially the same from the beginning. Different members of the staffs of oral surgery and oral pathology have done the work. About 30 per cent of the 100 treated patients returned periodically for recheck roentgenograms. The 6 cases presented were taken at random from these. The patients ranged from 10 to 58 years of age, the majority falling in the second and third decades.

Case 1.—A man, aged 26 years, had a chronic dentoalveolar abscess at the apex of the upper left lateral incisor. The first roentgenogram showed the condition at the time of operation, on May 12, 1946 (Fig. 2, A). The area of bony involvement was large, but the adjacent teeth were well protected by normal-appearing bone. Access to the root canal was through the mesial cavity, which is not an ideal approach. A direct straight line entrance is desirable.

The roentgenogram made a year and two months later (Fig. 2, C) showed good bone

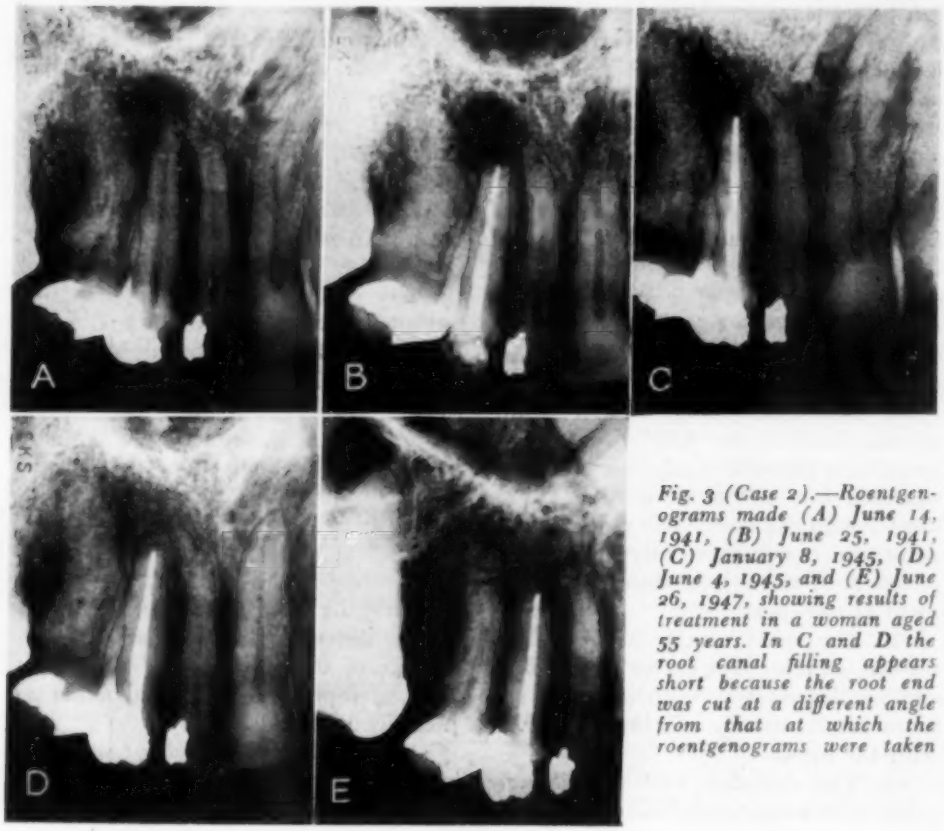

Fig. 3 (Case 2).—Roentgenograms made (A) June 14, 1941, (B) June 25, 1941, (C) January 8, 1945, (D) June 4, 1945, and (E) June 26, 1947, showing results of treatment in a woman aged 55 years. In C and D the root canal filling appears short because the root end was cut at a different angle from that at which the roentgenograms were taken

regeneration, with a well defined lamina dura. The space between the rounded lamina dura and the flat root end probably is occupied by cicatricial tissue. The good bone regeneration, we feel, indicates that there is no residual infection.

Case 2.—A woman 55 years of age had a large chronic dentoalveolar abscess at the apex of the upper left cuspid. The distal curvature of the roots of the first bicuspid placed them sufficiently far from the abscess so that surgical procedures were considered safe.

The result six years later seemed to indicate the wisdom of the treatment, since apparently normal cancellous bone had completely filled the formerly abscessed region (Fig. 3, E). The roentgenogram of January 8, 1945, showed lamina dura over the root end (Fig. 3, C).

Case 3.—A woman, aged 35 years, had greater involvement of the periodontal membrane and less involvement of the bone than the other patients in this series. It was necessary to resect about 5 mm. of root in order to remove all root involved with thickened periodontal membrane. The root was not cut as straight as might have been desired, but apparently the bone filled in properly. A good lamina dura was shown in the roentgenogram of July 2, 1947 (Fig. 4, E).

Case 4.—A lower left central incisor was treated in a 9 year old girl. The root canal filling showed a dark line, indicating lack of density. Bone filled the area perfectly, however, indicating that no infection remained.

The root end was intentionally resected at an angle, as the periodontal membrane was involved to a greater extent on the mesial than on the distal side of the tooth. The roentgenogram made on January 13, 1948

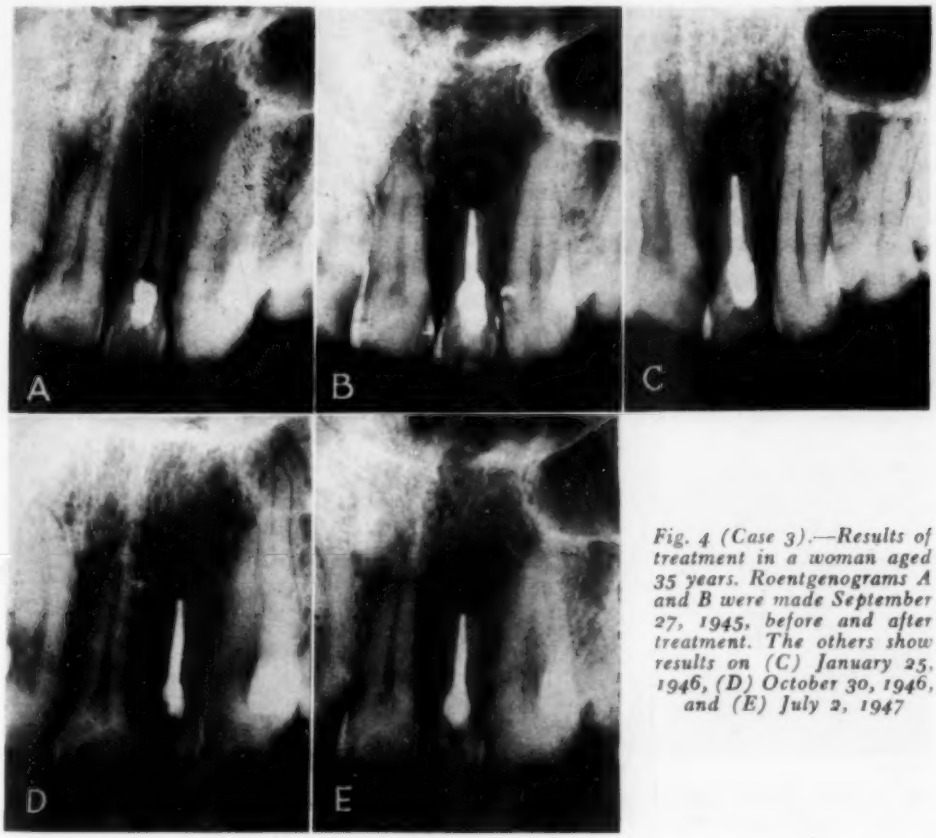

Fig. 4 (Case 3).—Results of treatment in a woman aged 35 years. Roentgenograms A and B were made September 27, 1945, before and after treatment. The others show results on (C) January 25, 1946, (D) October 30, 1946, and (E) July 2, 1947

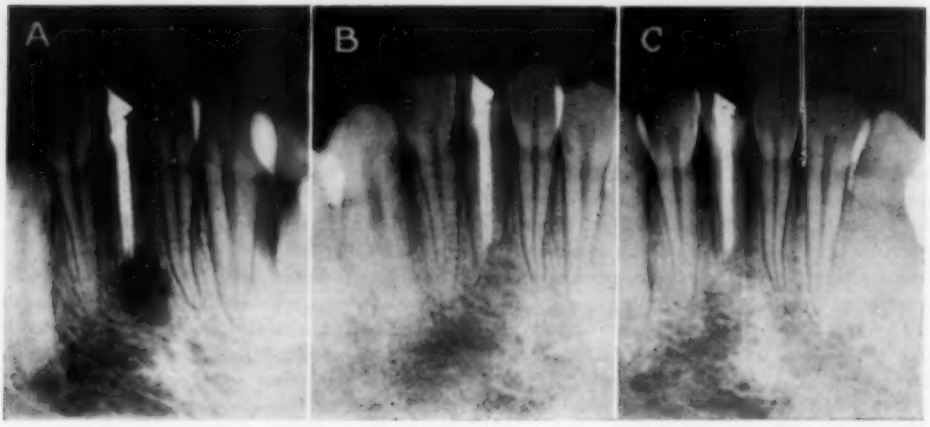

Fig. 5 (Case 4).—Roentgenograms made on (A) November 29, 1945, (B) February 5, 1947, and (C) January 13, 1948, showing results of treatment in a girl aged 9 years

(Fig. 5, C) showed a good lamina dura.

Case 5.—An upper left central incisor was treated in a 25 year old woman. About 3 mm. of root tip was removed, as is indicated by comparison with the right central incisor (Fig. 6, B). A good lamina dura with normal cancellous bone developed (Fig. 6, C).

Case 6.—A 14 year old boy had the upper right central and lateral incisors filled at the same time. In 18 months good cancellous bone had completely filled the periapical area, and a clean lamina dura was present over both teeth (Fig. 7, B).

Comment

Success may be assumed if roentgenograms indicate development of bone in the formerly radiolucent area. The region should be well filled in about six months after operation. The type of cancellation

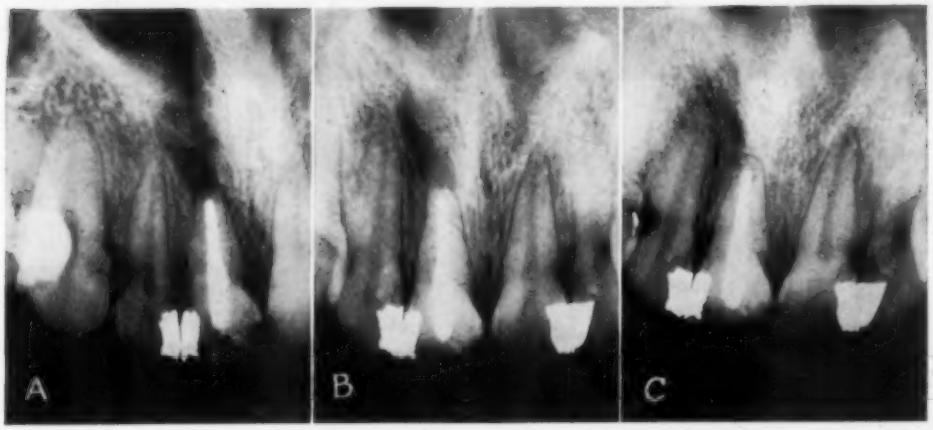

Fig. 6 (Case 5).—Roentgenograms made (A) February 7, 1944, (B) May 9, 1944, and (C) June 30, 1947, showing results of treatment in a woman aged 25 years

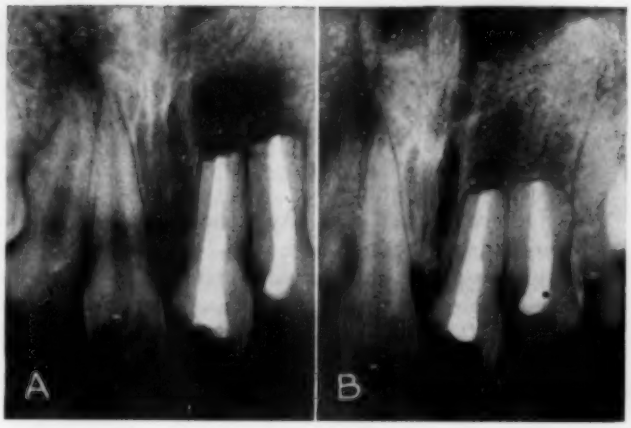

Fig. 7 (Case 6).—Roentgenograms made (A) May 22, 1945, and (B) November 18, 1946, showing results of treatment in a boy aged 14 years. In A there appears to be alveolar crest destruction in the interproximal space between the central incisors, but closer study shows bony cancellous structure, as in B. A variation in time and angle in exposure or development of film can produce such misleading results

usually is indistinguishable from surrounding bone. Sometimes the spaces are a little smaller than those in the rest of the bone, but this is of no importance. The ideal result would be establishment of a new lamina dura across the cut end of the root and continuous with the lamina dura along the sides of the root, illustrated in Figure 2. If this occurs, slight thickening of the periodontal membrane space between the lamina dura and the cut root end is of no moment. It would be desirable for cementum to develop across the cut surface of dentin, as reported by Hill,[1] but there is no evidence of this result in this series, since none of the treated teeth have been extracted. No evidence is available to indicate that a periodontal membrane with the typical fibrous structure of that tissue has developed. It seems likely that a fibrous cicatricial connective tissue occupies the area between the lamina dura and the root end. This is clinically satisfactory.

Summary and Conclusions

A technic for root amputation and root canal filling at one sitting is presented. So far as conclusions can be drawn in the length of time covered by this report, roentgenographic evidence indicates successful results.

The technic is relatively simple and requires no special equipment. The dentist should not hesitate to attempt it if he feels it is indicated.

The operation is contraindicated in some cases, as is, indeed, any root canal procedure. It is one way of attempting to save a tooth when its value to the patient seems to warrant the risks involved. The patient is frankly advised of the situation and shares the responsibility for the outcome.

The procedure is not suggested when dentoalveolar abscess is acute, but can be used after the acute symptoms have subsided.

1. Hill, T. J., *A Text-Book of Oral Pathology*, ed. 3. Philadelphia: Lea & Febiger, 1945, p. 262.

REPORTS OF COUNCILS

JUDICIAL COUNCIL

THE Judicial Council of the American Dental Association is required to render many opinions and decisions each year. Some of these opinions afford interesting reading as well as guides to reasonable conduct. In publishing them, all parts are deleted that would identify the inquirers or those whose names may be associated with the controversy. The questions raised in the following inquiries are covered by the Code of Ethics of the American Dental Association, copies of which may be secured by writing to the Central Office of the Association.

Dr., D.D.S. and Dentist

QUESTION: Please advise me regarding the appropriate use on my letterheads, signs and business cards of the following designations: Dr.; D.D.S.; Dentist. As I anticipate receiving my master's degree soon I would appreciate advice regarding its use.—*D.D.S., Illinois.*

REPLY: I know of no "Emily Post" rules to guide me in this reply and am, therefore, basing my suggestions on the principle of reasonable courtesy to others and current practices of professional men of good taste and judgment.

Dr.—You should so designate yourself on personal calling cards if these are used and on those occasions in which you find yourself obliged to identify yourself to a person who heretofore did not know you. Thus in signing a letter to someone who does not know you it would be well to designate yourself as: Dr.————.

Should you register in a hotel where you are not known you are obliged to sign the register as Dr. ————. The reasons for this are not to parade the doctor's title but rather to avoid being responsible for embarrassment to the people who may be required to address you. Surely it is discomforting for the personnel of a hotel to address you for several days as "mister" —and then come to know that you should have been designated as "doctor." The term doctor should also be used in the nonclassified section of telephone directories in those communities in which dentists so designate themselves in such directories. Otherwise there is little or no occasion for one to use the term "doctor" as a designation for himself.

D.D.S.—This designation is to be used after your name in signing prescriptions and on all other documents having to do with your professional services. It may be used otherwise as a substitute for "dentist" but not in combination with either "dentist" or "doctor."

Dentist.—This designation is proper on your stationery, professional (not calling) cards, office door lettering and building directories. It should be used alone and not in combination with other earned or honorary degrees.

Use of Master's Degree.—This should be used in combination with the D.D.S. degree in registers of faculties of teaching institutions, in bibliographies, such as is published in "Who's Who in America." It also should be used as part of the author's designations in those instances in which the publications consistently use all earned degrees in combination. Two degrees or more should not be used to-

gether on your calling card, office door lettering, building directory or telephone directory. The employment of plural degrees in such instances is bad taste in this country. It should be noted however that the use of two or sometimes more titles or designations is quite acceptable in many European and other foreign countries.—*Ernest G. Sloman, Chairman, Judicial Council.*

Inadequate Partial Dentures

COMMENT: Just a note to register a protest against certain types of partial dentures.

I honestly believe any and all "horseshoe" type partials, made only of unreenforced plastic, are such poor and detrimental dentistry as to be considered malpractice. The nature of the plastic is such that it is so weak it will inevitably either snap or warp and create dangerous frictional abrasion on the remaining teeth and cause hypertrophy of the gingiva.

I think all types of partial dentures lacking occlusal rests fall in the same category, causing more harm than good. Their constant riding against the abutment teeth and supporting gingiva can have only one end effect—destruction.

I am earnest in my desire to have this introduced and studied by the American Dental Association membership or an appropriate committee, and have the conclusions reached officially publicized. —*D.D.S., Connecticut.*

REPLY: Although a good case may be made against certain types of tooth replacement methods it is my opinion that it would be improper for the American Dental Association to recommend for or against given technics except to encourage clinicians and essayists to report their researches and convictions.

COUNCIL ON DENTAL THERAPEUTICS

THE STATUS OF MEDICINAL ZINC PEROXIDE

A PRELIMINARY report on zinc peroxide was published by the Council on Dental Therapeutics in 1943.[1] It was pointed out that there was no controlled dental clinical evidence of the usefulness of the product but that zinc peroxide has merit in certain fields of therapy.

A report entitled "Zinc Peroxide's Role in the Treatment of Vincent's Stomatitis," by Nizel and Rubin, appeared in the July 1943 issue of *The Military Surgeon.* In 1947 the Council voted that drugs for which there exists adequate evidence of usefulness in the treatment of disease in medical practice would be considered for acceptance as useful in the treatment of diseases of similar causation which occur in or about the oral cavity.[2]

The Council has decided to accept those brands of medicinal zinc peroxide which are marketed in accordance with

1. Council on Dental Therapeutics, American Dental Association, Preliminary Report on Zinc Peroxide. *J.A.D.A.* 30:942 (June 1) 1943.

2. Council on Dental Therapeutics, American Dental Association, Report of the Annual Meeting of the Council on Dental Therapeutics. *J.A.D.A.* 34:780 (June 1) 1947.

its rules and has adopted the following description:

Zinc Peroxide, Medicinal, U.S.P.—A mixture containing not less than 45 per cent of zinc peroxide, ZnO_2, together with zinc carbonate and zinc hydroxide.

Properties: Medicinal zinc peroxide occurs as a fine, white or faintly yellow, odorless powder. It is almost insoluble in water and organic solvents, but is readily soluble in dilute mineral acids.

Actions and Uses: Medicinal zinc peroxide decomposes slowly in the presence of moisture, releasing oxygen and leaving a residue of zinc oxide, zinc hydroxide and zinc carbonate. It is a mild astringent, antiseptic and protective agent. It is also useful as a deodorant for use in necrotic conditions associated with advanced carcinoma[3] or leukemia.

It has been proposed for use in the treatment of oral infections from anaerobic organisms[4] and for adjunctive use in the treatment of fusospirochetal stomatitis[5] and acute metallic stomatitis.

Dosage: Zinc peroxide, medicinal (powder), may be sterilized in small quantities (5 to 25 Gm.) by heating in a dry oven for four hours at *exactly* 140 C. The sterilized powder may be kept and used for about a month, after which time it begins to deteriorate slowly.

For clinical application, it is made up with sterile distilled water to a suspension of the consistency of very heavy cream. The amount depends on the size of the wound to be treated. Enough of the creamy suspension should be used to cover the surface of the wound with a layer approximately ⅛ inch thick. If the suspension is too thin it runs off. If it is too thick it may not come in contact with all surfaces in the crevices of the wound. The suspension should be a cream rather than a paste. The first layer, applied readily with a sterile syringe, is covered with a thin layer of cotton soaked in the suspension, and this in turn is covered with a thick layer of cotton wet with water and then sealed with an impermeable covering or coating of some kind. Dressings are usually changed in twenty-four hours but may be left for several days.

The dry powder has been applied to gingival tissue by means of a spray.[5]

3. Meleney, F. L., The Prophylactic and Active Use of Zinc Peroxide in Foul Smelling Mouth and Neck Infections. *Ann. Surg.* 107:32, (Jan.) 1938.

4. Meleney, F. L., Use of Zinc Peroxide in Oral Surgery. *Internat. J. Orthodontia* 23:932 (Sept.) 1937.

5. Nizel, A. E., and Rubin, Samuel, Zinc Peroxide's Role in the Treatment of Vincent's Stomatitis. *Military Surgeon* 93:49 (July) 1943.

PRELIMINARY COMMENTS ON DENTAL PRODUCTS

The following statements concerning products which are not accepted by the Council on Dental Therapeutics are designed to be free from controversial opinions. The Council may publish comprehensive status reports on these products whenever such reports are warranted, and will accept those which are found to be eligible for acceptance.

Barsal Tablets

Barsal tablets are stated to contain phenobarbital, ¼ grain; acetophenetidin, 1½ grains; acetylsalicylic acid, 3½

grains, and extract of gelsemium, 1/16 grain. Barsal is marketed for relief of pain and nervous tension. On the basis of the declared ingredients, one would expect it to be relatively effective.

Powdered extract of gelsemium was listed in the seventh (1942) edition of the *National Formulary*. The official dose was 1/6 grain (10 mg.) Gelsemium is the root of yellow jasmine, which contains several alkaloids. For a brief discussion of actions, uses and toxic effects, the reader may wish to refer to a text by Sollmann.[1]

In selecting analgesic and sedative medication, it is well to consider that preparations such as Barsal tablets are more potent than the commonly used 0.3 Gm. (5 grain) tablets of acetylsalicylic acid and that toxic effects generally increase with potency. The effects of mixtures are also more difficult to predict. The Council on Dental Therapeutics has encouraged the use of single drugs, rather than mixtures, for routine analgesia and sedation. The composition of Barsal tablets is unnecessarily complex.

Ideal Devitalized Pulp Treatment

This is a tablet preparation stated to contain iodoform, phenol and thymol. The directions for use specify that a crushed tablet be sealed in the devitalized tooth after the pulp has been removed and the pulp chamber has been swabbed with phenol or formocresol.

Since this product contains several soluble substances, this form of treatment would not seal the canal, an action generally considered essential for successful root canal work.[2] Furthermore, controlled studies have demonstrated that several 48 hour treatments with drugs similar to those contained in this product are often necessary before root canals become sterile and ready for filling.[3]

Del Mouth Wash

Del Famous 5 Drop Mouth Wash is stated to contain aromatics, 9.5 per cent; ethyl alcohol, 77 per cent; p-hydroxy benzoic acid esters, 1 per cent; distilled water, 12.47 per cent, and certified colors. All percentages are by weight. The product is designed for dilution before use.

The advertising claims unusual deodorant properties for the product. For example, it is claimed that odors due to upset stomach and the ingestion of garlic or alcoholic beverages are eliminated. Controlled scientific evidence to support these claims is lacking.[4]

A folder states, "Del helps to remove those dangerous food particles which often contribute to decay." The Council is not aware that the conscientious use of a product of this character will influence the dental caries process.

1. Sollman, Torald. *A Manual of Pharmacology*, ed. 7. Philadelphia: W. B. Saunders Co., 1948, p. 353.
2. Grossman, L. I., *Root Canal Therapy*, ed. 2. Philadelphia: Lea & Febiger, 1948, p. 279.
3. Ostrander, F. D., and Crowley, Mary. The Effectiveness of Clinical Treatment of Pulp-Involved Teeth as Determined by Bacteriological Methods. *J. Endodontia* 3:6 (Jan.) 1948.
4. *A.D.R.*, ed. 14, p. 131.

COUNCIL LISTS PRODUCTS FOR "ACCEPTED DENTAL REMEDIES"

THE Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following products in the list of *Accepted Dental Remedies:*

Mercury Preparations[1]

Mercresin Tincture, Stainless: A solution stated to contain secondary amyl tricresol,[2] 0.1 per cent; orthohydroxyphenylmercuric chloride,[2] 0.1 per cent; acetone, 10 per cent; alcohol, 50 per cent, and water. Distributed in 118 cc. bottles.

Mercresin Tincture is prepared by adding an inert washable orange dye to the stainless tincture. Distributed in 118 cc. bottles. Manufactured by the Upjohn Company, Kalamazoo, Mich.

Antibiotics[3]

Crystalline Penicillin G Procaine for Aqueous Injection—Abbott: Addition of water for injection or isotonic sodium chloride solution gives a suspension in which each cubic centimeter contains crystalline penicillin G procaine, 300,000 units, sodium carboxymethylcellulose and Tween 80. Marketed in 300,000 units (single dose) vials, 1,500,000 units (five dose) vials and 3,000,000 units (ten dose) vials.

Penicillin Potassium Tablets (Soluble) —Abbott: Stated to contain crystalline penicillin G potassium, 50,000 units; citric acid; sodium benzoate, and sodium bicarbonate. Distributed in bottles of 12. Manufactured by Abbott Laboratories, North Chicago, Ill.

Anesthetics—Local[4]

Procaine HCl 2%, Neo-Synephrine 1:2500: Each cubic centimeter is stated to contain procaine HCl, 0.02 Gm.; phenylephrine, HCl, 0.0004 Gm.; chlorobutanol, 0.005 Gm.; sodium chloride, 0.0005 Gm.; potassium sulfate, 0.003 Gm.; sodium thiosulfate (anhydrous), 0.001 Gm.; sodium bisulfite, less than 0.00067 Gm., in distilled water. Marketed in 2.4 cc. cartridges. Manufactured by the Anestex Laboratories, Pittsburgh.

Anesthetics—Local—Slightly Soluble[5]

Topical Anesthetic—Oradent: Each 100 Gm. is stated to contain benzocaine, 10 Gm.; chlorobutanol, 5 Gm.; dioctyl sodium sulfosuccinate, 1 Gm.; peppermint oil and clove oil, 0.2 Gm.; certified color, and propylene glycol. Manufactured by the Oradent Chemical Co., Inc., New York.

Oxidizing Agents[6]

Zinc Peroxide, Medicinal,[7] U.S.P.: Distributed by Mallinckrodt Chemical

1. *A.D.R.*, ed. 14, p. 82.
2. Council on Pharmacy and Chemistry, American Medical Association, *New and Nonofficial Remedies*—1948. Philadelphia: J. B. Lippincott Company, 1948, pp. 99-100, 634-635.
3. *A.D.R.*, ed. 14, p. 59.
4. *A.D.R.*, ed. 14, p. 39.
5. *A.D.R.*, ed. 14, p. 57.
6. *A.D.R.*, ed. 14, p. 86.
7. Council on Dental Therapeutics, American Dental Association, The Status of Medicinal Zinc Peroxide. *J.A.D.A.* 39:75 (July) 1949.

Works, St. Louis, and Merck & Co., Inc., Rahway, N.J.

Admission to *Accepted Dental Remedies* means that the product was found to conform to the rules of the Council when it was accepted. Accepted products are reconsidered periodically. The files of the Council contain information on many drugs and dental cosmetics, and inquiries are welcomed.—*Donald A. Wallace, Secretary.*

COUNCIL ON DENTAL RESEARCH

ADDITIONS TO LIST OF CERTIFIED DENTAL MATERIALS

SINCE the publication of the most recently revised list of certified dental materials (List of Certified Dental Materials Revised to November 1, 1948. *J.A.D.A.* 38:358, March 1949) the following products have been added:

Certified Amalgam Alloys (A.D.A. Specification No. 1)

Alloy	*Manufacturer or Distributor*
National Dental Alloy	Eskay Dental Products
Safco 69	Safco Laboratories

Certified Inlay Casting Gold Alloys (A.D.A. Specification No. 5)
Type A, Soft

Alloy	*Manufacturer or Distributor*
Ney-Oro AA	The J. M. Ney Company

Certified Dental Mercuries (A.D.A. Specification No. 6)

Mercury	*Manufacturer or Distributor*
Dental Mercury	Drug Laboratories, Inc.

Certified Silicate Cements (A.D.A. Specification No. 9)

Cement	*Manufacturer or Distributor*
Diafil	Pfingst and Company, Inc.

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EDITORIALS

CARL O. FLAGSTAD, CHAIRMAN COUNCIL ON LEGISLATION, 1888-1949

CARL O. Flagstad, efficient and aggressive chairman of the Council on Legislation of the Association, died in Minneapolis, June 16, 1949. It can be said truthfully that in laying aside his instruments at the early age of sixty-one he became a martyr to his profession, as the strenuous program to which he subjected himself on behalf of dentistry must surely have contributed to his early passing. He had just completed the preparation of his testimony on the Army dental bill which is designed to improve the status of the Army Dental Corps, and which he helped write, when he was stricken with a heart attack from which he never recovered.

In addition to serving as chairman of the Council on Legislation he conducted a private practice, was professor of dental prosthesis at the University of Minnesota School of Dentistry, chairman of the curriculum committee of that institution and active in the affairs of the Minnesota State Dental Association and the American Association of Dental Schools.

During his thirty-eight years in the profession he established an enviable record as practitioner, teacher, administrator, legislator and tactician. Blunt, aggressive, kindly, honest to the core and imbued with the highest ideals of dentistry, he will be recorded in the history of the profession as one of its most stalwart members.

Dr. Flagstad's passing at this time, when his ability and energy are so sorely needed, is a distinct blow to both the profession and the public, to his many friends and admirers and to his family, which unselfishly he sacrificed along with himself in his fight for a just cause.

ADVANCES IN MEDICAL AND DENTAL RESEARCH DECREASE THE COST OF HEALTH SERVICE

THE authors of the latest national health bill (S. 1679) introduced into Congress on April 25 justify its proposals by stating that the tremendous advances in medical science in recent years have increased the cost of health services to such an extent that the vast majority of our people cannot meet the shattering cost of serious or chronic illness, nor can most of our people benefit from modern preventive medicine.

Like many of the arguments advanced by exponents of compulsory health insurance, this contention is open to serious question. True, medical science has progressed tremendously during the past half century. But most of the progress has lowered instead of raised the costs of medical care and has placed the benefits of preventive medicine in the hands of greater numbers of people. Would the sponsors of S. 1679 have use believe that vaccination has not lowered the cost—both in lives and dollars—of smallpox? Would they have us believe that toxin-antitoxin and toxoid have not reduced the financial toll incident to diphtheria, or that countless thousands have not been spared the cost of treatment of typhoid, paratyphoid and scarlet fever, malaria and other diseases through the use of simple, inexpensive immunization and sanitary measures, or that early and accurate diagnosis and treatment has been inimical to the financial interest of the tuberculous patient? Do they ignore completely the fact that the sulfonamides and antibiotics are currently saving countless weeks of hospitalization and medical treatment for patients suffering from pneumonia, septicemia and osteomyelitis, and that for the first time in history the incidence of dental caries, the most prevalent disease of mankind, bears promise of being reduced radically through the talent of the research worker?

True, hospital room costs have increased during the past twenty-five years, but so too have the costs of housing and of hotel and even hall bedrooms. Also, modern medical science has compensated partially for increased hospital costs by reducing radically the average patient's period of hospitalization.

Facts refute the contention that advances in medical and dental science have advanced the cost of health care. On the contrary, each forward step taken by the scientist in his relentless war against disease decreases the consumer's expenditure for medical and dental service.

In decrying the increased costs of specific health services, proponents of compulsory health insurance must know, though they do not acknowledge, that such increases have been balanced to a great extent by comparable increases in wages. Social economists know too, though some of them do not acknowledge, that the fees of the physician and dentist during this period of spiraling prices have not been increased in proportion to the national increase in wages or the increase in costs of living. Undoubtedly an unbiased study would reveal that the patient today receives more for his medical dollar than he did a quarter of century ago. It is one thing to proclaim a cause, it is another thing to employ half truths to promote it.

MOISTURE INJURES ALLOY FILLINGS: STOP PALMING AMALGAM

SINCE the days of the Crawcours and their "Royal mineral succedanium," amalgam has played an important part in the practice of dentistry. Where once its use resulted in an amalgam war which threatened to disrupt the profession, it now is recognized as one of the profession's most practical filling materials.

The Council on Dental Research of the American Dental Association, cooperating with the National Bureau of Standards, has taken a leading role in improving the quality of dental amalgam restorations by establishing specifications for the guidance of alloy manufacturers. Alloys which meet those specifications are certified by the manufacturer to the Council. Today, therefore, it is possible for dentists to buy with confidence alloys that meet the requirements established by authoritative bodies.

The use of a certified alloy, however, does not guarantee a good amalgam filling. Correct manipulative procedure by the dentist is equally necessary in order to secure satisfactory results.

Research has demonstrated that even though the cavity is prepared properly and filled with an amalgam made from a certified alloy, the filling may prove faulty because of incorrect amalgamation and condensation. Two errors committed by some dentists are the palming of amalgam in the bare hands and the condensing of the filling in the presence of saliva. These practices have caused amalgam fillings to be defined anonymously as "a mixture of perspiration, epithelial cells, saliva, mercury and an alloy usually containing silver, tin, copper and zinc."

If amalgam containing zinc—and most of them do—is palmed with the bare hands or condensed in a cavity contaminated with saliva, or if moisture condenses on the amalgam as it is placed in the mouth, expansion and excessive corrosion of the filling almost invariably follow. This explains why so many amalgam fillings protrude from the cavity, have fractured margins and are black, pitted and corroded. It explains, too, some of the postoperative pain experienced by patients.

The Council on Dental Research of the Association has requested all manufacturers of dental alloys on the List of Certified Dental Materials to revise their mixing directions so as to eliminate the recommendation that amalgam be palmed, and to caution dentists against any practice that contaminates the amalgam with moisture during mixing and condensing. The Council also has collaborated with the National Bureau of Standards in the production of a sound and color motion picture film which demonstrates an acceptable amalgam technic.[1]

Studies made by the Research Council, the Bureau of Standards and the research departments of dental manufacturers have provided the profession with excellent alloys. These studies also have proved that excellent alloys will not result in excellent restorations if the amalgam is palmed or inserted in the presence of moisture.

1. This film may be borrowed, without charge other than transportation, from the Director, National Bureau of Standards, Washington 25, D. C.

DENTAL FOCI OF INFECTION:

GOOD CASE HISTORIES NEEDED

An article entitled "Dental Infection and Extraoral Disease," by Walter H. Nadler, M.D., published in this issue of THE JOURNAL, serves to revive lagging interest in the subject of oral foci of infection. Concurrent with the publication of this article comes a report from the American Geriatrics Society that Doctor Otto Meyer, a New York vein specialist, states that infection of the jugular veins starts as a rule in the small veins of the teeth and tonsils. The observation of Doctor Meyer is added to the list of evidence favoring the elimination of all oral infection.

The pendulum of professional opinion regarding the removal of infected teeth has swung from one extreme to the other during the past third of a century. Now it seems to have centered nearer the midline. After the pronouncement by Billings on focal infection in 1916 and the reports of Rosenau in 1921, a wave of tooth extraction swept the country. Physicians and dentists alike sought relief for their ailing patients in the wholesale removal of teeth.

"But," states Doctor Nadler, "as time went on it was found that many patients were not, in fact, benefited by extraction of their teeth . . . a reaction to too much zeal was inevitable . . . the medical and dental professions now, it appears, are in some danger of underestimating the frequency and importance of focal infection."

This subject is so important to public and personal health that it must not be underestimated by the professions. Most physicians and dentists can cite instances in which the removal of dental infection has improved a patient's physical condition. Rarely, however, can practitioners substantiate their observations with clinical reports. The main reason for the existing confusion of opinion regarding oral foci of infection is the absence of authentic case records. Now that dental specialties are being placed on a sound basis and dental departments are being established in more hospitals the keeping of adequate dental case histories in institutions and in private practice will become routine procedure. In time data from these reports will supply scientific evidence for or against the case of oral foci of infection.

INTERNATIONAL CORRESPONDENCE

NEWS FROM BRITAIN

Once again the representatives of the dental profession are at loggerheads with Health Minister Aneurin Bevan. He has requested that a meeting be held to discuss a further interim alteration of the fee scale for dental treatment under the National Health Service.

Despite the cut introduced in February, the dental service is costing too much, the government says, and a further reduction in fees is necessary. The dentists have refused to discuss the matter saying that no time factor upon which to base new alterations exists. It has been agreed that the scale of fees should be based on a time factor for dental operations and at present the Penman Committee is analyzing the results of a time study conducted among dentists to establish such a factor. The dentists will insist on waiting until the report is available since they do not want to agree to something which might be prejudicial. Mr. Bevan decided not to wait for the publication of the Penman report and on May 20 introduced a memorandum reducing fees 20 per cent overall. This new scale took effect June 1.

The memorandum recalled that the original scale, introduced on July 5, 1948, was designed to produce for the fully employed, experienced dentist a net annual income of £1,778 ($7,112). Preparation of this scale was done without accurate figures making certain assumptions necessary. Estimates had to be made of the average time taken to perform various dental operations, the number of hours to be worked per week and average practice expense. In presenting the scale for the profession's agreement the Minister stressed that it was temporary and would be reviewed in the light of experience within the first year. He had agreed to accept the Spens estimate of 33 chairside hours per week as the average number of work hours per week.

Practice expenses, it was generally accepted, amounted to rather more than 50 per cent of the dentist's gross earnings so the Spens figure was more than doubled. Within a few months of operation it became obvious that certain dentists were earning a far higher rate than had been expected. While it was agreed that there was no justification to introduce a general cut in the scale of fees, all income above £4,800 ($19,200) was halved under a new regulation. This limitation permitted remuneration at the full rate up to an amount which was about 25 per cent above that based on the Spens Committee's figure.

A week after the Minister asked for the formation of the Penman Committee he wrote to the dental organizations referring to the possibility of consultations with them about an interim revision of the scale of fees while they were waiting for information upon which to base a more permanent scale. He did not feel able to comply with the dentists' attitude that he should not consider any reduction before the Penman Report was available.

A table was drawn up showing the annual rate of payment authorized by the Dental Estimates Board to 5,078 dentists taking part in the Service whose earnings during the six months October 1948 to March 1949 could be regarded as reasonably reflecting an annual rate. This takes no account of the limitation of earnings above £4,800 ($19,200) a year gross imposed in respect of payments made on or after Feb. 1, and does not make allowance for superannuation.

The memorandum points out that about 59 per cent of the 5,078 dentists were earning incomes above the annual rate suggested in the Spens Report. It was most probable that additions to the above amounts would be earned as the result of private practice, and especially would this apply to the group of 41 per cent who were not earning the rate suggested by the Spens Report.

The Minister felt that the preparation of the Penman Report and the negotiations following it would take time and agreement with the dental organizations' request would cause an unjustifiable drain on the Exchequer.

The amended regulations provide for a reduced scale of fees in respect of work undertaken after May 31. This scale supersedes the limitation on earnings which will be brought to an end on July 31.

The New Scale

	Former £ s d	*Present* £ s d
Examination and Report	0 10 0	0 5 0
Scaling	0 16 6	0 12 6
Fillings:		
Maximum	1 17 6	1 7 6
Minimum	1 0 0	0 15 0
Root Treatment:		
Maximum	3 0 0	2 5 0
Minimum	2 0 0	1 10 0
Extractions:		
1 or 2 teeth	0 10 0	0 7 6
3 to 5 teeth	0 15 0	0 11 6
6 to 8 teeth	1 0 0	0 15 6
9 to 11 teeth	1 5 0	0 19 6
12 to 14 teeth	1 10 0	1 3 6
15 to 17 teeth	1 15 0	1 7 6
18 to 20 teeth	2 0 0	1 11 6
Over 20 teeth	2 7 0	1 17 6
General Anesthetics:		
1 to 3 teeth	0 10 0	0 10 0
4 to 11 teeth	1 0 0	1 0 0
12 to 19 teeth	1 10 0	1 10 0
20 or more teeth	2 0 0	2 0 0
Dentures:		
Full upper and lower	10 10 0	9 9 0
1 to 3 teeth	4 17 6	4 5 0
4 to 8 teeth	5 15 0	5 0 0
9 to 14 teeth	6 1 6	5 7 6
Repairs:		
Maximum	2 0 0	1 15 0
Minimum	0 18 0	0 15 6
Crowns:		
Maximum	9 7 6	8 5 0
Minimum	4 7 6	3 17 6

The English pound is currently worth about $4.00 in U. S. currency.

The Council of the British Dental Association has issued advice to its members stating:

> The recent decisions of the Minister of Health which demonstrate the insecurity for a dentist in the National Health Service have resulted in many enquiries from members of the association as to the line of action which they should take.
>
> In response to these enquiries the council can only reiterate the official policy of the association—namely, that it cannot recommend its members to take part in the service in view of the complete omission of those principles regarded by the association as essential to provide a satisfactory service for the public.
>
> The council is of the opinion that decisions, whether to remain in the service, to resign from the service under the new conditions or to refrain from undertaking work in the service while remaining on the list of an executive council, must be taken by members of the association as individuals. The council would recommend that, if a member, after due and careful consideration, considers that he is unable to give, in the health service, the high standard of treatment which is possible in private practice, the procedure should be to give the three months' statutory notice necessary for the removal of a name of a practitioner from the list of an executive council.

Notations

The annual meeting of the British Dental Association was to be held at Scarborough from June 20 to 24. J. M. Macrae, F.D.S. Eng., was to be installed as president. . . . The Dental Board of the United Kingdom has awarded a research grant to G. N. Jenkins, of the University of Durham, to continue his research on the protective factors in unrefined carbohydrates against caries; the role of vitamin D in caries control and the nature of the anti-caries factor present in dog saliva. . . . The last examination for the Higher Dental Diploma (H.D.D.) of the Royal College of Surgeons of Edinburgh has been held. In November of this year the first examination for the newly instituted Fellowship in Dental Surgery of the College will be held. . . . William Guy, former dean of the Edinburgh Dental School, has written his reminiscences "Mostly Memories." Dr. Guy is now more than 90 years old. He is an LL.D. of Pennsylvania.—*John R. Boyes, Newcastle Upon Tyne.*

THE NATIONAL SCENE

from The Journal's Washington Correspondent

Entering the home stretch of its 1949 session, the 81st Congress appears to be resolved to enact several bills involving dentistry from various angles—clinical care, education, public health and research. The past month on Capitol Hill witnessed the introduction of a number of Senate and House bills affecting this field, as well as many days of public hearings on prospective legislation that had been filed earlier in the session.

A brief résumé would show that bills which moved forward toward adoption in June included those providing for federal aid to dental schools and students in need of financial help, administrative parity for the Army's dental branch, establishment of a National Science Foundation (dental research would come within the Foundation's cognizance), government support of local public health units throughout the country and miscellaneous minor measures less broad in scope.

With reference to newly introduced legislation, the greatest stir was caused by an all-Republican omnibus health bill authorizing federal support of voluntary prepayment plans which scale their premiums to subscribers' income and agree to place themselves partly under control of U. S. Public Health Service. S.1970, as it is designated, specifically defines "personal health services" as those rendered by dentists as well as physicians.

Unlike the other national health bills now under consideration by Senate and House committees, including the Thomas-Murray-Dingell compulsory health insurance measure, S.1970 makes no provision for aid to dental education. However, one of its sections calls for a comprehensive, impartial survey of the country's health services, which would include a study of current training of dentists and dental hygiensts, their geographic distribution, economic problems and so forth.

S.1970 is in the hands of the Murray health subcommittee of Senate Labor and Public Welfare Committee. Its eight identical counterparts in the House are under consideration by the Priest subcommittee of the Interstate and Foreign Commerce Committee. During the greater part of June, these two groups conducted public hearings on the Thomas-Murray-Dingell, Taft and Hill health bills but S.1970 was introduced too late for inclusion in the early stages of the hearings.

Among witnesses who testified before the subcommittees were the late Carl O. Flagstad, for American Dental Association; Russell W. Bunting, dental dean at University of Michigan, and Cornell Grossman, testifying as an individual dentist. The latter is from Millburn, N. J. Dr. Flagstad presented arguments against compulsory health insurance and the others devoted their testimony to the subject of dental education. Dr. Bunting indorsed the principle of government assistance to institutions and students. Dr. Grossman was concerned solely with the desirability, in his opinion, of permitting high school graduates to matriculate directly into dental and medical schools and having the U. S. government guarantee loans made to the medically indigent for purposes of obtaining medical or dental care.

Shortly before the middle of June, the House and Senate subcommittees concluded hearings on federal assistance to

professional education, following which conferences were begun with Dr. Bunting, Dean J. Ben Robinson of University of Maryland's dental school and others in an effort to iron out differences in details. It was regarded as certain that agreement would be reached on all major points and prospects are bright for final enactment of a bill.

The Murray Health Subcommittee of the Senate is proceeding with dispatch in its public hearings and "marking up" of proposed national legislation pertaining to dental and medical care, subsidization of institutions giving training in the health sciences and government support of research. In contrast, the House subcommittee is moving so slowly that it faces the necessity of drastically speeding up its hearing schedule if the legislative machine is not to be held up.

The "marking up" conferences mentioned above were to have been participated in jointly by staff members of the Senate and House Health Subcommittees, together with spokesmen for dental and medical education. But the prospective delegation from the House side of the Capitol failed to appear—because its members were unable to find the hearing room on the Senate side.

Although even the most voluble proponents of compulsory health insurance have long since abandoned hope for victory in the present session of Congress and even the chances of new laws on hospital expansion and aid to local public health units—which seemed bright until recently—may die in the rush for adjournment, all signs are indicative of the Congress enacting some form of financial assistance to medical and dental schools. Scholarships may be included also.

In-Training Courses

Launched late in June, Veterans Administration will continue through July a series of in-training courses in oral medicine for professional personnel in its hospitals. The courses are being given by Lester W. Burket, director of post-graduate studies at University of Pennsylvania dental school; Edward V. Zegarelli, associate professor of dentistry at Columbia University, and B. O. A. Thomas, professor and executive officer of the department of periodontology, University of Washington school of dentistry. Bion R. East, assistant medical director for Veterans Administration dental services, estimated that 40 per cent of Veterans Administration dental personnel would attend the courses. Dr. Burket is covering the middle west, Dr. Zegarelli the southeast and Dr. Thomas the western section of the United States.

LEGISLATION

A.D.A. URGES PASSAGE OF ARMY DENTAL BILL AT HOUSE AND SENATE HEARINGS

Four official A.D.A. witnesses appearing before the Armed Services committees of both Houses of Congress, June 20, reiterated the Association's official stand in favor of companion bills S.1205 and H.R. 3479 which are designed to provide authority commensurate with responsibility for the Army Dental Corps. Both the Association's Council on Federal Government Dental Corps and Council on Legislation were represented.

A request for the hearing was made by the Association when it was learned recently that the Department of the Army had informed Senator Millard E. Tydings, chairman of the Senate Committee on Armed Services, in a letter that the "Department of the Army is opposed

to the . . . bill." Senator Lester Hunt (D., Wyo.), himself a dentist, and Representative L. Mendell Rivers (D., S. C.) arranged for the hearings.

The letter, signed by Gordon Gray, acting secretary of the Army, referred specifically to S.1205 and stated that such legislation would "tend to fix by statute the duties and powers of a particular Corps within the Army. Such a tendency is contrary to the recommendation of the Hoover Commission, and is at variance with what are considered sound principles of organization within executive agencies." Mr. Gray also contended that many of the bill's provisions already are in effect under current Army regulations. Originally, Army Surgeon General Raymond W. Bliss indicated that he had "no personal objections" to the A.D.A.'s efforts to achieve authority commensurate with responsibility for the Dental Corps similar to that which is in effect under law in the Navy.

Initial Testimony

T. J. McDermott, of Cleveland, Ohio, vice-chairman of the Council on Legislation, presented the initial testimony given by the A.D.A. group in place of the late Carl O. Flagstad, who died just four days before the hearing was to be held.

Outlining various provisions of the bill by sections, Dr. McDermott struck at the Army's contention that regulations are sufficient to provide a workable administrative system for the Dental Corps. He said in part: "The Department of the Army has objected to the bill on the ground that it will tend to strengthen by statute a particular Corps of the Army. The Association hopes it will. Army Regulations in the past have not been such as to be conducive to making the dentist feel that he has a place of responsibility in the Army, and when after considerable pressure those regulations have been made more or less satisfactory the Army has not hesitated to alter them almost overnight."

Pointing out that dentistry has a right to administrative equality within the Services as it has proved itself capable of acquiring in civilian life, Dr. McDermott added that the bill calls for "responsibility to the Office of the Surgeon General —not to members of the medical profession serving in the Army."

Witness Sustains Fire

Hitting again at the unbalanced administrative arrangements, which another witness testified still exist in some Army commands despite the introduction of the "new" regulations, Dr. McDermott said: "Most outstanding complaint . . . [in the last war] . . . was the domination of the administration of dental affairs by medical officers and the lack of administrative authority vested in the Dental Corps."

Using dentistry's 100-year old professional history to establish the point that the profession now is fully established as an individual health service, Rudolph H. Friedrich, chairman of the Council on Federal Government Dental Corps stated that "as the result of this evolutionary development, it [dentistry] must assume in full the responsibility for the professional obligations it has accrued and it must have the authority with which to carry out those obligations. If there is to be effective and economical administration of dental services in federal agencies and elsewhere, persons trained specifically in dentistry must be permitted to administer dental programs and to work cooperatively with all other professions devoted to the provision of a comprehensive health service."

The Army Medical Department's "inadequate administrative program" was another of Dr. Friedrich's targets. He said that "this problem should have the studied attention" of the Congress "to

prevent the continuation of conditions which can impair seriously the health program in a national emergency."

"The basic problem," he said, "is the familiar concept that a dental program must be administered by a medical officer even though he is not qualified by interest, education, licensure or experience to do so."

Indicating that he thought "autonomy" for the Dental Corps would be extreme, and perhaps based on the "antiquated notion that dental health has no relation to total health," Dr. Friedrich said that "authority commensurate with responsibility" is essential. It would aid in the establishment of a "clear cut definition of functions, services, and activities," eliminating "a chaotic administrative pattern which must reveal itself in diminished efficiency and a lower quality of service."

Cites Efficiency and Morale

W. R. Alstadt, Little Rock, Ark., consultant to the Council on Legislation and an Army veteran, specified "efficiency of administration" and "espirit de corps" as basic reasons for improving the Dental Corps' administrative position. He pointed out that the unwarranted transfer of trained enlisted personnel continues to be a problem even though the regulations provide that the Dental Surgeon has complete control over them.

In discussing "espirit de corps," Dr. Alstadt said that as a member of the Arkansas State Board of Dental Examiners he has discussed "with many veterans of the Army Dental Corps and with many recent graduates during the past three years their attitudes toward the Army Dental Corps. . . . the verdict is unanimously discouraging."

"I realize," he said, "that someone will remind me that regulations were changed September 27, 1948, to incorporate many of . . . [the bill's] . . . points. The trouble lies in the indisputable evidence that regulations can be changed overnight and even if the regulations were never changed. . . . It has been reported to me very reliably that many Dental Surgeons are having difficulty with the present regulations because various medical officers, and in some cases, commanding officers of the installations, choose to interpret the regulations as they see fit."

O. G. Skelton, Dallas, Texas, a retired Army Dental Corps officer, also testified and Francis J. Garvey, secretary of the Council on Legislation, coordinated the A.D.A. testimony.

C-H-I PROPONENTS INDICATE ISSUE WILL BE KEPT ALIVE

Despite the announcement by Senator Scott W. Lucas (D., Ill.) that the Administration's current Thomas-Murray-Dingell compulsory health insurance bill would not be acted on at this session of Congress, President Truman reiterated his determination to get passage as soon as possible. This coupled with the facts that hearings on the measure may continue until Congress adjourns and that Federal Security Administrator Oscar Ewing has been appearing again on the speakers' platform indicates, according to Washington observers, that strong efforts to get enactment at the next session of Congress will continue throughout the summer and fall.

A.D.A. Testifies on C-H-I

The A.D.A. gave its testimony on the bill May 25 before both Houses of Congress through the late Carl O. Flagstad, chairman of the Association's Council on Legislation. In addition to the statements previously reported in THE JOURNAL, the official testimony contained a six point program for immediate action designed to provide dental care "to all, regardless of income or geographical location." It also stressed that "programs developed for dental care should be based on pre-

vention and control of dental diseases."

The six points follow:

1. The prevention of diseases through the application of preventive technics as soon as they are demonstrated to be scientifically valid; the support of intensified dental research with adequate funds, personnel and facilities.

2. The control of dental diseases by the expansion of community dental programs, integrated in the general health program to make dental care and dental health education available to every child.

3. The provision of additional facilities and uniform standards for dental care by making dental services available in hospitals and health centers for in-patients and out-patients.

4. The recruitment of an annual enrollment of dental students equal to the capacity of all dental schools to increase the number of qualified dentists.

5. The adoption of measures to make dental practice in smaller cities and rural areas more attractive and rewarding in order to procure a better distribution of dentists.

6. The employment of dental hygienists as auxiliary aids to the dentist; the provision of additional courses for those who desire to qualify for positions in the public health department.

Among those attending the hearing with Dr. Flagstad were Thomas J. McDermott, vice-chairman of the Council; Francis J. Garvey, Council secretary, and several other central office staff members. Others who acted as consultants to the Council included Daniel F. Lynch, Washington, D. C., A.D.A. fourth district trustee; C. Willard Camalier, Washington, D. C., assistant A.D.A. secretary; J. Ben Robinson, member of the A.D.A. Council on Dental Education and dean of the University of Maryland dental school; Shailer Peterson, secretary of the Council on Dental Education; Gerald Timmons, president-elect of the American Association of Dental Schools and dean of Temple University dental school; Manly Michaels, Washington, D. C., consultant to the Council on Legislation. B. Duane Moen, assistant director of the A.D.A. Bureau of Economics Research and Statistics and H. B. Bain, director, Bureau of Public Information, also represented the Central Office.

DENTAL SOCIETIES

MASSACHUSETTS DENTISTS JOIN OTHERS AGAINST C-H-I

The Massachusetts Dental Society, representing about 95 per cent of all registered dentists in that state, recently joined the many other organizations which have passed resolutions memorializing Congress not to enact current compulsory health insurance legislation.

A copy of the resolution was sent to all Congressmen and Senators from Massachusetts in addition to the speaker of the House and the president of the Senate. The resolution said in part: "the Massachusetts Dental Society does hereby memorialize the Congress of the United States not to enact any legislation containing the principle of compulsory health insurance."

The American Dental Hygienists Association passed a similar resolution recently and urged all of its constituent societies to take similar action.

NEW ENGLAND SOCIETY OF ORAL SURGEONS ELECT OFFICERS

Thomas G. Little, of Springfield, Mass., recently was elected president of the New England Society of Oral Surgeons, at the organization's annual meeting. Other officers elected include: William D. MacIntosh, Providence, R. I., vice-president; Walter C. Guralnick, Boston, secretary; Joseph A. Doherty, Boston, treasurer and Kurt H. Thoma, Brookline, Mass., editor.

DENTO-MEDICAL SEMINARS UNDER WAY IN RHODE ISLAND

A series of six seminars on dentistry and oral medicine are being conducted under the auspices of Brown University department of medical sciences and the Rhode Island State Dental Society, according to Michael B. Messore, Society president.

In commenting on what he believes is the first such program to be held in this country, Dr. Messore said that endorsement in principle has been given by the Rhode Island State Medical Society. Charles A. McDonald, chairman of the University's department of medical sciences, shares responsibility for conducting the seminars with Dr. Messore.

Among the subjects being discussed by the guest lecturers are: focal infection in the etiology of disease; nutrition and dental medicine; heart disease; the influence of health and disease on the growing child, and diagnosis and treatment of oral tumors.

A. D. A. AFFAIRS

STATE SOCIETY SECRETARIES MEET TO DISCUSS EXPANDING INFORMATION PROGRAMS

Representatives of 19 state dental societies meeting in Chicago, June 13-15, for the second A.D.A. State Secretaries' Management Conference, reached agreement that now is the time to plan additional opposition to compulsory health insurance legislation which is expected to be a major issue during the next session of Congress.

In all, 20 state society secretaries and executive secretaries, and one assistant to the president of a dental society met at the Central Office to discuss dental public relations and information programs. The first such meeting, held last November, stressed dental society administration.

Chairman of the conference was Louis M. Cruttenden, assistant secretary of the A.D.A., who opened the meeting with an outline of the scope and objectives of the program.

Lead-off man among the 15 speakers on the program was Lars Carlson, of Chicago, district representative of the Oil Industry Information Committee, who spoke on the general role of public relations. He placed particular emphasis on the need for unity in a national information and education program, using a series of slides to illustrate what can be done to place an educational message before the public. The use of individual, local and community effort in effecting such a program was stressed.

Kenneth J. Ward, a vice-president of J. Walter Thompson Co., nationally known advertising and public relations firm with headquarters in Chicago, discussed the basic requirements of a public

relations program. His remarks largely were confined to the task of "telling the public."

Using his experience with the Chicago Heart Association fund raising drive, Mr. Ward described various approaches to acquiring cooperation in a public relations program. He stressed the importance of the dentist's personal attitude in dealing with people both in and outside the office.

Targets of the Program

Speaking on the same general topic but directing his discussion toward the "targets of a public information program and the groups to be reached," L. T. Maloney, Boston, assistant to the president of the Massachusetts Dental Society, specified the entire problem of dental health as the number one target. Second and third most important targets were listed as national Children's Dental Health Day and special events in general. He emphasized the importance of working directly with the medical profession at the state and local levels and pointed out that unity within dentistry is essential to the success of any public relations program.

H. B. Bain, director of the A.D.A. Bureau of Public Information, who with Dr. Cruttenden and a committee of Central Office staff members is credited with much of the conference planning, informed the conferees that establishment of a firm policy by the proper authorities in a dental society is the "keystone" of any successful public relations program. Adding that public opinion is never static, he stressed the importance of elevating public relations thinking above the level of press agentry. A public relations committee is needed in every state dental organization to carry out policy, he said.

In the portion of the program dealing with public relations in the field of national health programs, Lon W. Morrey, editor of THE JOURNAL, traced the development of the present federal administration's campaign to promote compulsory health insurance.

Showing that efforts to install such "insurance" in the United States can be traced to the early 1900's, Dr. Morrey traced the development of some of the proposed schemes and stressed the fact that the danger is greatest today. The current campaign for enactment of compulsory health insurance began in earnest about ten years ago with the first Wagner health bill in 1939.

The campaign has become more serious each year with the continuing and expanded use of federal funds by administration sponsored leaders, he said.

"All pronouncements on compulsory health insurance made by . . . [administration spokesmen] . . . and by certain senators and representatives in Congress are prepared by a small group of nationalized health service exponents who seem to be firmly entrenched in the Federal Security Administration," Dr. Morrey concluded.

A "Courageous" Stand

Stressing the A.D.A.'s "courageous" stand for a cooperative effort to solve the strong social problem of health care in general, Harold Hillenbrand, secretary of the Association, warned against the danger inherent in the "opposition's emotional use of dental need" as a baseline in discussions of all social legislation.

The A.D.A. has stood against the mechanism of compulsory health insurance and not the objective of improving the nation's health, he said.

Current compulsory health legislation is "intellectually dishonest," Dr. Hillebrand stated, adding that the A.D.A. for ten years has had a counter-proposal to accomplish the announced objectives. Such a program, however, cannot compete in a "dramatic way," he said.

Expansion of dental education and re-

search is the only way in which need for dental care and ability to produce such care will ever be brought into balance, the speaker said, adding that programs to improve dental health should be controlled at the local and state levels.

At another point in the conference, Dr. Hillenbrand discussed briefly his observations of the British compulsory health insurance scheme made during his recent journey across Europe.

Francis J. Garvey, secretary of the A.D.A. Council on Legislation, speaking on technics for legislative programs, stressed the present need for continued vigilance and action by organized dentistry in preparing to oppose renewed efforts by the proponents of compulsory health insurance. He also urged that increased attention be given to analyzing all legislation which might have indirect bearing on dentistry and the other health professions.

The A.D.A.'s public information program, directed mainly at educating the public on the dangers of compulsory health insurance, was reviewed by Mr. Bain in an effort to describe what has been done so far. The technics employed in this program were the major point of discussion.

State Societies Speak

Each state society representative described his organization's individual program which covered a wide variety of projects including the distribution of A.D.A. prepared material, the use of slogan "stickers," distribution of reprinted articles from state dental journals, the use of speakers and establishment of dental speakers bureaus, the operation of school dental health education programs and health education conferences.

Those who spoke informally on this subject included the following: John G. Rooks, San Francisco, executive secretary, California State Dental Association; James Robinson, Los Angeles, executive secretary, Southern California State Dental Association; Walter Holland, Washington, D. C., executive secretary, District of Columbia Dental Society; Paul W. Clopper, Peoria, Ill., secretary, Illinois State Dental Society; E. E. Ewbank, Kingman, Ind., secretary of the Indiana State Dental Association; Harry I. Wilson, Des Moines, Iowa, secretary, Iowa State Dental Society; Julian S. Bernhard, Shreveport, La., secretary, Louisiana State Dental Society; Arno M. Bommer, Revere, Mass., secretary, Massachusetts Dental Society; Fred Wertheimer, Lansing, Mich., secretary, and Henry C. Gerber, Jr., executive secretary, Michigan State Dental Society; Carl V. E. Cassel, Minneapolis, secretary, Minnesota State Dental Association; C. S. Renouard, Butte, Mont., secretary, Montana State Dental Association; F. A. Pierson, Lincoln, Neb., secretary, Nebraska State Dental Association; John G. Carr, Camden, N. J., secretary, New Jersey State Dental Society; Charles A. Wilkie, Brooklyn, secretary, Dental Society of the State of New York; H. Leon Snow, Oklahoma City, executive secretary, Oklahoma State Dental Association; H. C. Fixott, Jr., Portland, secretary, Oregon State Dental Association; Ray Cobaugh, Harrisburg, Pa., executive secretary, Pennsylvania State Dental Society; T. T. McLean, Nashville, executive secretary, Tennessee State Dental Association; and Kenneth F. Crane, Milwaukee, executive secretary, Wisconsin State Dental Society.

The final day of the conference was devoted to a series of formal discussions on the public relations aspects of state dental society activities. Speakers and their subjects are as follows: Mr. Robinson, maintaining membership; Mr. McLean, publicizing state society meetings; Mr. Cobaugh, promoting Children's Dental Health Day; Dr. Cassel, stimulating interest in research; Dr. Wilkie, dealing with auxiliary services; Dr. Carr, cooperating with health agencies; and Edgar T. Stephens, of the Chicago

Dental Society, using dental health education material. Accomplishments of the conference were discussed by Charles H. Jamieson, Detroit, chairman of the Advisory Committee to the A.D.A. Bureau of Public Information, and Mr. Bain, the Bureau's director.

A.D.A. MEMBERSHIP CERTIFICATE NO LONGER BEING ISSUED

An announcement restating that membership certificates will not be issued to members of the A.D.A. this year was released by the Office of the Assistant Secretary late last month.

Reason for the announcement, according to Louis M. Cruttenden, assistant secretary, is that many members are requesting the document which has been abolished by action of the Board of Trustees. He emphasized, however, that the regular membership card will continue to be issued upon payment of dues.

A.D.A. PRESIDENT C. E. MINGES RECEIVES HONORARY DEGREE

In commencement ceremonies marking conclusion of the University of Louisville's 151st year on June 13, Clyde E. Minges, president of the A.D.A. and graduate of the University's dental school in the class of 1919, was given an honorary LL.D. degree.

John W. Taylor, University president, in conferring the award read a citation which said: "Clyde E. Minges, dentist, administrator, distinguished alumnus of the University of Louisville, officer of numerous state, national and professional organizations, lecturer, public health official, consultant to the Surgeon General of the United States Army, recipient of many honors and awards, fellow of the American College of Dentists, fellow of the International College of Dentists, now president of the American Dental Association."

ACTIVE MEMBERS IN A.D.A. DOWN ONE PER CENT WHILE TOTAL MEMBERSHIP RISES FIVE PER CENT

Total active membership in the A.D.A. reached 62,136 during the first five months of this year, or slightly less than one per cent below the total active membership figure of 62,744 reached on June 1, 1948. The entire Association membership soared to a plus five per cent over last year's membership of 68,169 during the same period having touched 71,586.

H. C. Jarvis, chairman, Council on Membership, interpreted the current membership trend as indicating that by year's end the active membership will exceed that of previous years. He pointed out that 31 constituent societies recorded from one to 25 per cent fewer active A.D.A. members in the five month period and that these percentages probably will drop. Among the other constituents reporting almost all show an increase of from one to 67 per cent more active members.

The increase in total membership is attributed largely to a rise of from 3,375 student members to 7,044.

A tabulation of the entire membership showing June 1, 1949 totals and percentage gain or loss over the same date in 1948 follows:

	1949	% Gain or Loss
Alabama	515	— 2
Arizona	166	6
Arkansas	303	3
California	2,207	— 2
So. California	2,747	2
Colorado	560	6
Connecticut	1,125	— 8
Delaware	95	12
Dist. of Columbia	504	— 6

Florida	738	22
Georgia	633	— 2
Hawaii	231	6
Idaho	161	58
Illinois	4,820	— 3
Indiana	1,351	— 11
Iowa	1,057	— 8
Kansas	657	— 10
Kentucky	691	4
Louisiana	624	— 2
Maine	272	— 8
Maryland	663	— 1
Massachusetts	2,334	— 2
Michigan	2,420	— 1
Minnesota	1,945	— 4
Mississippi	320	10
Missouri	1,667	9
Montana	220	0
Nebraska	741	— 3
Nevada	64	0
New Hampshire	186	— 3
New Jersey	2,708	0
New Mexico	110	— 13
New York	9,694	1
North Carolina	676	— 10
North Dakota	222	1
Ohio	3,070	— 1
Oklahoma	589	3
Oregon	726	— 1
Panama Canal	19	6
Pennsylvania	4,559	— 5
Puerto Rico	163	— 15
Rhode Island	335	— 2
South Carolina	241	— 1
South Dakota	223	— 4
Tennessee	705	— 2
Texas	1,947	3
Utah	285	6
Vermont	119	0
Virginia	709	0
Washington	1,051	1
West Virginia	463	— 10
Wisconsin	1,897	— 4
Wyoming	78	— 25
Army	318	22
Navy	424	34
Public Health Service	185	67
Vet. Admin.	607	— 3
Unorganized	6	200
Total Active Membership	62,136	— 1
Affiliate	273	7
Associate	2	
Student	7,044	109
Life	2,131	19
Honorary	5	25
Total Membership	71,586	5

TESTIMONIAL LUNCHEON FOR R. H. VOLLAND IS PLANNED

R. H. Volland

Among the highlights of the 90th annual session of the A.D.A., to be held Oct. 17-20, in San Francisco, will be a testimonial luncheon for Roscoe H. Volland, past-president and former treasurer of the Association. The affair will be held at the Fairmount Hotel, Oct. 17.

Dr. Volland, who until last September held the treasurership of the A.D.A., will be honored for his many contributions to dentistry as president, treasurer, trustee and member of the Research Commission of the Association.

Speaking on Dr. Volland's efforts while treasurer and member of the Board of Trustees will be Daniel J. Lynch, of Washington, D. C., a trustee. C. S. Foster, of Cedar Rapids, Ia., also a trustee, will talk on his experience as a former student and close friend of Dr. Volland. Arthur H. Merritt, A.D.A. president in 1939-40, also will speak.

Other speakers include Clyde E. Minges, A.D.A. president; Harold W. Oppice, Chicago, A.D.A. trustee; B. C. Kingsbury, San Francisco and Samuel Sonders, Rochester, N. Y. Reservations for the luncheon are being taken by Will G. Sheffer, 601 Medico-Dental Building, San Jose, Calif. The A.D.A. Business Office urges members to make convention reservations early.

DENTAL EDUCATION

DENTAL SCHOOL AND HOSPITAL AFFILIATE TO FORM CLINIC

An affiliation between Northwestern University dental school and Children's Memorial Hospital, Chicago, has been completed in an effort to make the hospital's dental clinic "a model dental department." The development was announced by Charles W. Freeman, dean of the dental school and John P. Wilson, president of the hospital board.

Under the administration of Gordon H. Rovelstad, dental school faculty member in pedodontia, the clinic will be open to both hospitalized children and out-patients. Most important function of the clinic, it was stated, will be consistent dental care for young cardiac, diabetic and orthopedic patients, as well as juvenile victims of other illnesses requiring long hospitalization. Oral surgery and treatment for cleft lip and palate also will be provided.

The clinic has been supported in part by the National Park College Alumni Foundation of Chicago and will be given additional funds from a gift of $100,000 to Northwestern's dental school for research in pedodontia.

MINNESOTA DENTAL SCHOOL TO OFFER ORAL MEDICINE SEMINAR

The University of Minnesota school of dentistry will offer its fourth annual seminar for the study and practice of oral medicine, Sept. 22-24, under direction of David F. Mitchell, chairman of the division of oral pathology and William J. Simon, chairman of the division of oral diagnosis.

A variety of subjects will be offered by a faculty consisting of Joseph L. Bernier, chief of the Army Institute of Pathology section of dental and oral pathology; Reed O. Dingman, editor of the *Journal of Oral Surgery* and associate professor of oral surgery, University of Michigan; George S. Easton, head of the University of Iowa dental school department of oral diagnosis; Martin Estine, Klahr Dental Clinic, Philadelphia; Leonard S. Fosdick, Northwestern University; John M. Gules, Marquette University dental school; Roland W. Harrison, University of Chicago; Harold C. Hodge, University of Rochester; Stanley A. Lovestedt, Mayo Clinic, Rochester, Minn.; Richard S. Manly, Tufts College director of research; Gustav W. Rapp, Loyola University (Chicago), John R. Thompson, Northwestern University, professor of orthodontics.

Additional information may be secured by writing the Director of Postgraduate Dental Education, Center for Continuation Study, University of Minnesota, Minneapolis 14.

TEACHER SHORTAGE PERSISTS DESPITE INCREASED SALARIES

Although the nation's dental schools have been raising faculty member salaries since 1943, they still are experiencing difficulty in recruiting new teachers, a survey being conducted by the A.D.A. Council on Dental Education indicates.

With more than half of the survey questionnaires now in the Council's hands, it is disclosed that since the last such survey conducted in 1942-43 pay scales for all levels of dental education have been increasing. In 1943 full professors in the dental schools were being paid as little as $2,400 and only as much as $10,000 annually. Today, according to the Council's preliminary figures, the scale ranges from a low of $3,000 to a top of $14,400 for the same rank.

Shailer Peterson, Council secretary, under whose direction the survey is being

carried out, states that while a complete evaluation of the survey cannot be made yet, it is significant that student bodies in the dental schools vary so widely in size.

In 1948-49 freshman enrollments were from 12 to 150 while total school sizes range from 46 to 559. Full dental school classes are expected to rise this coming year from a total of 10,029 to more than 11,500.

Returning to salary scales, Dr. Peterson added that dental school instructors now are getting between $1,500 and $6,000 a year as compared to 1942-43 when they could earn only from $1,000 to $3,900. Associate professors now get from $3,000 to $8,750 where they were getting from $2,400 to $6,000 and assistant professors today are getting from $3,000 to $7,500 where they formerly got from $2,200 to $5,400. A complete evaluation of the survey will be published in a future issue of THE JOURNAL.

DEAN OF ROCHESTER MEDICAL, DENTAL SCHOOL GOES TO HARVARD

George Packer Berry, professor of bacteriology and associate dean of the University of Rochester school of medicine and dentistry, has been appointed dean of the Harvard medical school, according to James B. Conant, president. He is a physician and has conducted extensive research in such diseases as yellow fever, encephalitis and "parrot fever." He succeeds C. Sidney Burwell who has resigned to devote full time to teaching and research.

FIRST MIDDLE ATLANTIC STATES ORAL MEDICINE SEMINAR HELD

A total of 58 dentists and physicians from the United States and Canada attended the first Middle Atlantic States seminar in oral medicine conducted by the postgraduate division of the University of Pennsylvania school of dentistry, May 22-27. The program featuring nine speakers was directed by Lester W. Burket, director of the dental school's postgraduate courses.

The six-day program included lectures, motion pictures and seminar sessions conducted by dentists, surgeons and general practitioners based generally on the clinical application of the biologic and medical sciences. All participants were members of the American Dental Association, American Medical Association or of comparable groups.

ORAL SURGERY FELLOWSHIP OFFERED BY GEORGETOWN

A teaching fellowship in oral surgery for a dentist with two years of postgraduate training is being offered by the Georgetown University dental school, according to John P. Burke, dean.

The position will be open Aug. 1, Dr. Burke said, adding that it offers opportunity to take work leading to a Master of Science in oral surgery degree. Additional information may be secured by writing the dean, Georgetown University school of dentistry, 3900 Reservoir Rd., N.W., Washington, D. C.

VETERANS

V.A. ACTS TO ESTABLISH NEW HOSPITAL DENTAL PROGRAM

In a preliminary move toward the establishment of intern and residency programs for dentists in Veterans Administration hospitals, two dental school deans recently were appointed to serve in the Tuskegee Veterans Hospital, Tuskegee, Ala. The appointments were made by Bion R. East, assistant medical director for dental service of the V.A.

Clifton O. Dummett, professor of den-

tistry and dean of Meharry Medical College dental school, Nashville, Tenn., has been appointed chief of dental service at the hospital and Joseph Volker, dean of the new dental school at the University of Alabama, has been named to the "deans committee." Dr. Dummett will take a month's tour of duty at Hines Veterans Hospital, Hines, Ill., before assuming his hospital duties, Aug. 1. He has been granted an indefinite leave of absence from Meharry but will continue to serve the school in an advisory capacity.

Other dental school deans appointed to the "deans committee" are: O. M. Dressen, Marquette University, to the Veterans Hospital, Wood, Wisc; Ernest M. Jones, University of Washington, to the Veterans Hospital, American Lake, Wash. and Lawrence E. VanKirk, University of Pittsburgh, to the Veterans Hospital, Aspinwall, Pa.

The "deans committees" were organized early in 1946 to assist in establishing consultants and residents in V.A. medical instutitions as a means of insuring high standards of medical care for veterans.

PUBLIC HEALTH

The first of its kind to be put in service in Britain, this mobile dental clinic was designed by F. J. Saunders, senior officer of the Kent County Dental Service. A fully equipped dental laboratory is a feature of the trailer unit which is being used largely for the County children's dental service. Also housed in the trailer are a reception room, surgery, recovery room, laboratory and x-ray facilities.

WATERWORKS GROUP FAVORS FLUORINATION RESOLUTION

The American Waterworks Association, meeting in Chicago, early last month passed a resolution to the effect that they were willing to fluorinate drinking water supplies if and when the public wanted such action taken and when local medical and dental societies and public health departments approved.

Both public and private water utilities represented at the meeting expressed strong feeling against paying for the fluorination, it was reported. They contended that the estimated cost of about ten cents per person should be absorbed by public health authorities.

ARMY AND NAVY

NATIONAL GUARDSMEN TO GET ARMY MEDICAL EDUCATION

The Army's graduate professional education program has been opened to officers of the National Guard and an initial quota of ten residencies in orthopedics and three in physical medicine have been made available, according to Maj. Gen. Kenneth F. Cramer, chief of the National Guard Bureau.

Plans currently are under study, according to Gen. Cramer, for expanded participation of National Guard medical officers in the Army program of graduate medical study, which provides approved training in various fields of medical and surgical specialties.

ARMY RESUMES POSTGRADUATE TRAINING FOR DENTAL OFFICERS

A program of postgraduate training in dentistry for Regular Army dental officers has been undertaken for the first time since the war by the Army Dental Corps, according to Lt. Col. J. S. Oartel, assistant director, dental division, Army Medical Center, Washington, D. C.

Under auspices of the dental division of the Medical Department's research and graduate school, seven U. S. dental officers and one dental officer of the Royal Canadian Dental Corps are now well into the first four-month course. All phases of dentistry are to be covered in their studies which are designed to fulfill a training requirement in the "career pattern for Dental Corps officers as specified by the Department of the Army."

The program is under direction of Brig. Gen. Oscar P. Snyder and instruction is provided by the chiefs of section of the dental and medical services of Walter Reed General Hospital, the Armed Forces Institute of Pathology, the National Bureau of Standards and by the attending dental staff of the Army Medical Center. Special lectures are presented by representatives of Surgeon General's office, the Air Surgeon's office, the U. S. Public Health Service, the National Institute of Dental Research and other outstanding specialists in dental education and private dental practice. The next course is scheduled to begin late in August.

APPLICANTS FOR DENTAL POSTS SOUGHT BY FEDERAL AGENCIES

While the Navy was announcing openings for dentists to serve as civilians for a year in the islands of the Trust Territory, the U. S. Civil Service Commission disclosed that the deadline for regular appointment applications is July 5.

According to the Navy, civilian dentists are being sought for positions among the islanders. These positions pay slightly more than $6,000 a year. Applicants must pass a physical examination equivalent to that required for military service and must agree not to enter private practice in the area after their contracts expire. Additional information is available from the district dental officer, Twelfth Naval District, 50 Fell St., San Francisco.

Regular civil service examinations, for which applications are being solicited call for applicants to be licensed to practice dentistry and have from one to four years experience. Most of the vacancies are in the Children's Bureau, Washington, D. C., the Indian Service and the U. S. Public Health Service in Washington, and throughout the country. No written examination is required. Applications may be secured from most first and second class post offices, from the Civil Service regional offices, or from the Civil Service Commission, Washington 25, D. C.

GENERAL NEWS

CARL O. FLAGSTAD, CHAIRMAN OF LEGISLATIVE COUNCIL, DIES

Carl O. Flagstad

Carl O. Flagstad, chairman of the A.D.A. Council on Legislation, died June 16 following a heart attack which hospitalized him for two days. He had been scheduled to present the Association's views in favor of a bill to provide authority commensurate with responsibility for the Army Dental Corps with the Medical Corps before the Armed Services committees of the House and Senate on June 20, and had just completed preparation of the testimony when he was stricken.

A native of Minneapolis and a figure in organized dentistry for more than 20 years, Dr. Flagstad had been a practicing dentist and teacher for 38 years and was 61 years of age. He was graduated from University of Minnesota school of dentistry in 1911 and immediately entered the dental school as a professor of denture prosthesis. For the past ten years he has been chairman of the school's curriculum committee.

Dr. Flagstad became active in the A.D.A. in 1928 when he was appointed clinic chairman of the local arrangements committee, going on to become general chairman of the A.D.A. Clinic Committee in 1930. It was in 1935 that he became a member of the Association's Legislative Committee which later became known as the Council on Legislation. He served as its vice-chairman in 1943-44 and was chairman from 1944 until his death. In addition, Dr. Flagstad was secretary of the Full Denture Section of the A.D.A. and vice chairman of the Section at the 89th annual session, held last September.

Serving in many capacities at the state and local dental society levels, Dr. Flagstad was president of the Minneapolis District Dental Society in 1927; editor of the *Minneapolis District Dental Journal*, 1928-30; and member of the society's executive council for eight years. He was elected president of the Minnesota State Dental Association in 1933 after having served on the program committee from 1926. He was chairman of that organization's war service committee from 1942 to 1944.

As a long-time member of the American Association of Dental Schools, Dr. Flagstad was elected its secretary-treasurer in 1940 and served in that capacity until 1946. He was in line for the position of president-elect of the A.A.D.S. this year. His wife and four children survive.

FORMER MARYLAND DENTAL DEAN, T. O. HEATWOLE, DIES

Timothy Oliver Heatwole, dean of the University of Maryland dental school from 1911 to 1924, died in Baltimore recently. He was the school's second dean and upon his retirement from that position he became secretary of the University's Baltimore schools, a position he held until 1937.

During Dr. Heatwole's administration academic standards were raised, the curriculum strengthened and many improvements in the school's buildings and equipment were made. He also had been active for many years in state and local politics, serving one term in the Maryland House of Delegates and three consecutive four-year terms on the Baltimore City Council.

G. H. HILLENBRAND, FIFTY YEARS A DENTIST, SUCCUMBS

George H. Hillenbrand, father of the present secretary of the A.D.A., Harold Hillenbrand and a practicing dentist for nearly 50 years, died June 8, at 76 years of age.

Born in Sun Prairie, Wisc., Dr. Hillenbrand was graduated from Northwestern University dental school and entered general practice in Chicago where he remained until his retirement a few years ago.

G. WALTER DITTMAR, FORMER A.D.A. PRESIDENT, SUCCUMBS

G. W. Dittmar

G. Walter Dittmar, of Chicago, past-president of the A.D.A. and three other dental societies, died recently after completing 51 years as a dentist. He was 77 years of age.

A graduate of Northwestern University, Dr. Dittmar last year was honorary chairman of the 89th annual session of the A.D.A. He became active in dental association activities early in his career and served as a delegate to the third International Dental Congress in Paris, in 1900, later becoming president of the Chicago Dental Society and the Illinois State Dental Association in 1911 and 1920 respectively. He was president of the A.D.A. in 1932-33.

DENTAL EXPERIENCES WITH CEREBRAL PALSIED SOUGHT

An invitation to all dentists who have examined or treated a patient with cerebral palsy to communicate with the Dental Guidance Council for Cerebral Palsy has been extended by the Academy of Medicine, 2 E. 103rd St., New York.

The purpose of the request, according to the Council, is to "add to present knowledge and eventually to form an information center to aid the profession in treating these multiple handicapped children and adults."

DEATH NOTICES FOR JUNE AND MARCH JOURNALS CORRECTED

The June issue of THE JOURNAL inadvertently published on page 813, in its obituary notices, the name of William D. Williams, of New Cumberland, W. Va. Dr. Williams is not dead and currently is a member of the Wheeling District Dental Society, the West Virginia State Dental Society and the A.D.A. He was graduated from Ohio State University dental school in 1918 and is 52 years of age.

In the March issue, the name of a John E. Davidson, of West Point, Ga., was published on page 410 and he was credited with having been a graduate of Indiana University dental school. The graduate of Indiana is another dentist of the same name who currently is practicing in Elkhart, Ind.

CARE CONDUCTING NEW BOOK CAMPAIGN TO AID WAR AREAS

The international relief agency CARE has inaugurated a new book campaign designed to replenish the libraries of overseas technical schools and universities, according to Paul Comly French, executive director.

Stressing that CARE's book program is not a "used book" campaign, a pamphlet issued by the agency states that the donor may specify the general category in which the book should fit and

the institution to which it should be sent if his gift is for more than $10. Dentistry is included among the approved categories. For further information write CARE Educational Unit, 50 Broad St., New York 4.

OREN A. OLIVER IS HONORED AT EMORY COMMENCEMENT

Oren A. Oliver, of Nashville, Tenn., former president of The American Dental Association and past president of the American Board of Orthodontists, received an honorary degree of Doctor of Laws from Emory University at the commencement exercises held early last month. He also appeared as a speaker on the two-day program with A. Hollis Edens, president of Duke University and Vice-president Alban W. Barkley.

JOINT DENTAL DIRECTORS SERVE BROOKLYN HOSPITAL

M. Hineburg, executive director of the Jewish Hospital of Brooklyn, has announced that M. D. Levin and Abraham Levine are serving jointly as chiefs of the hospital dental staff. The A.D.A. Council on Hospital Dental Service recently granted a certificate of approval to the hospital.

BLUE CROSS MOVES TO UNIFY HOSPITALIZATION PROCEDURES

In a move calculated to make Blue Cross hospitalization insurance coverage available to subscribers away from home, the Blue Cross Commission, national coordinating agency for the 90 Blue Cross Plans in the United States and Canada, has announced formation of a new Inter-Plan Service Benefit Bank.

Provisions of the new program provide that persons hospitalized away from home will be treated temporarily as though they were members of the Plan in whose area they receive care. They will be entitled to full service benefits of the local Plan, provided by the contractural arrangements between the Plan and its own local hospitals, rather than the more limited payments heretofore available to subscribers hospitalized out of their own area, the Commission states.

This action is also seen as another move to strengthen the voluntary health care plans against attack from proponents of national compulsory health insurance.

CHECKLIST OF GERMAN MEDICAL, DENTAL PERIODICALS AVAILABLE

An interim checklist of holdings of 168 German medical and dental periodicals for the period 1939 to 1948 has been compiled by the Medical Library Association's committee on periodicals and serial publications. The periodicals on the new list are in 38 libraries in this country and Canada. Further information may be secured by writing Edith Dernehl, Marquette University medical library, 561 N. 15th St., Milwaukee 3.

NEW JOURNAL DEVOTED TO CANCER MAKES APPEARANCE

A new journal titled "Cancer," devoted to the presentation of the "advances in cancer to readers with diverse interests," made its debut in May under the colors of the American Cancer Society and Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, New York.

Fred W. Stewart, a physician, is the editor and in his "apologia" he states that the new journal will attempt to be "comprehensive in coverage of human cancer and things related." Only original and unpublished work will be accepted for publication, he says.

The first issue contains 175 pages and a number of illustrations.

DENTAL STUDENT'S REGISTER NOW AVAILABLE FROM A.D.A.

The Dental Student's Register for 1948 which contains enrollments of dental schools, undergraduate enrollments and similar statistical information is now available from the A.D.A. Council on Dental Education, according to Shailer Peterson, Council secretary. Also contained in the Register are listings of schools of dental hygiene and schools of dentistry.

INTERNATIONAL

TWO AMERICAN DENTISTS TO SPEAK AT ROYAL COLLEGE

Two members of the American Academy of Oral Pathology will present papers before the British Royal College of Surgeons in London on July 15.

Kurt H. Thoma, of Brookline, Mass., will speak on fibrous tumors of the maxilla and mandible, and Joseph L. Bernier, of Washington, D. C., will discuss carcinoma of the lip. Both will attend the annual faculty dinner.

PUERTO RICAN DENTISTS HONOR TWO FROM MAINLAND

The Puerto Rico Colegio de Cirujanos Dentistas, a constituent society of the A.D.A., recently presented honorary memberships to J. Ben Robinson, dean of the Baltimore college of dentistry, and Olin Kirkland, former trustee of the A.D.A. from Montgomery, Ala. The awards were made during the society's annual meeting.

Bruce D. Forsyth, assistant surgeon general, U. S. Public Health Service and Rear Adm. A. W. Chandler, of the Navy Dental Corps, also attended the meeting as guest lecturers.

MEXICAN ORTHODONTISTS NAME OFFICERS FOR YEAR

The Associacion Mexicana De Orthodontica (Mexican Orthodontic Association) has elected Manuel Vaderrama Herrera as president.

Other officers elected are: Manuel Castro Cue, secretary, and Carlos M. Paz, treasurer.

OFFICERS ELECTED AT FIRST MEETING OF INDIAN DENTISTS

Following inauguration of the first meeting of the Dental Council of India by Rajkumari Amrit Kaur, minister of health, May 14, the Council elected officers to serve on the executive committee. New officers are: K. C. K. E. Raja, New Delhi, president; N. N. Berry, New Delhi, vice-president and V. M. Desai, Bombay, R. Ahmed, Calcutta, S. K. Majumdar, Calcutta and R. Prakash, Dehra Dun.

DENTAL SPECIALTY SOCIETIES IN ARGENTINA HOLD ELECTIONS

Two Argentine dental societies recently elected officers for the year.

The Sociedad Agentina De Orthodontica (Argentine Orthodontic Society) elected the following: Edmundo G. Locci, president; Carlos F. de la Torre, vice-president; Enrique Uhalde, secretary; Gustavo Cornejo Saravia, assistant secretary; Elio A. DeMaria, treasurer and Carlos M. Arce, assistant treasurer.

The Sociedad Argentina De Cirugia Dento-Maxilo-Facial (Argentine Society of Dento-Maxillofacial Surgery) elected the following: Renato A. Vivone, president; S. Abel Sticco, vice-president; Normando Quercilhac, secretary; Homero D. Bianchi, assistant secretary and Reynaldo Dabadie, treasurer.

BOOK REVIEWS

Child Care Questions and Answers. Children's Welfare Federation of New York City, Inc. 159 pages. Price $2. New York: Doubleday & Company, Inc., 1948.

Sound, practical advice is presented throughout this handy-sized book which contains 420 questions and answers for parents. It is evident that all possible care was taken in assembling the material and working out the brief but adequate replies. The fact that a general medical committee and a special field committee cooperated in the work undoubtedly adds to its value in that a two-phased approach to the problems is included.

The questions, grouped under eight general headings, cover almost every conceivable problem of child rearing. An important point is made in the introduction: Knowledge on this subject is not passed on from generation to generation; therefore the problem is perennial. It must also be recognized that medical opinion concerning certain aspects of child care has changed and will continue to change. An up-to-date discussion such as this one is needed to help banish the superstitions that still dominate some parents' thinking.

Generally speaking, all sections of the book are of equal value. It should be noted, however, that detailed attention is given to the currently much-discussed emotional guidance of children, their development and feeding, and their medical care, including seventeen specific questions and answers on dental care. Every dentist and every physician will be pleased to have this volume in the hands of parents, for it is certainly a rational consideration of subjects which the professions sometimes are inclined to consider too casually or not at all.—*William W. Bolton, M.D.*

Methods of Vitamin Assay. By The Association of Vitamin Chemists, Inc. 185 pages. Index. Price $3.50. New York: Interscience Publishers, Inc., 1947.

Methods of Vitamin Assay is one of the most valuable books available to individuals concerned with vitamin analyses. Its compactness, convenience of arrangement, and authoritative nature justify its inclusion in the personal library of workers from the technician to those on the research or supervisory grades. The cooperative efforts of a large number of individuals and laboratories testing the various details of numerous procedures contribute particularly to the book's authoritativeness. The literature references are rather extensive, appear to be well chosen, and are listed in a very useful form.

The book has certain limitations some of which are inherent in the subject matter and some of which may be overcome in a future revision. Workers in the field of dental research may be somewhat disappointed by the relative paucity of material dealing specifically with clinical procedures. The emphasis on the analysis of foods is understandable, but the Association of Vitamin Chemists could perform an additional valuable service by stimulating cooperative projects for the evaluation of procedures designed for clinical work. To some technicians, the inclusion of extensive notes within the body of the text may give the procedures a superficial appearance of extreme complexity. These extensive notes, however, are among the most valuable features of the book.

The collaborators should be commended for including an initial discussion of the necessity for adequate sampling procedures. This reviewer has the definite impression, however, that the attempt to condense and simplify this material may lead to some confusion on the part of the reader. An illustration of this point may be found in the discussion on the lower half of page seven. To the casual reader, the example may seem to imply that when a coefficient of variation amounting to 15 per cent is obtained with twenty individual samples one may, under similar circumstances, anticipate a coefficient of variation of 10 per cent when only fifteen individual samples are employed.

It is to be hoped that revisions of this book can appear at sufficiently frequent intervals to provide a continuously up-to-date and perhaps a slightly improved form of this very valuable contribution to the field of vitamin analysis.—*J. Roy Doty.*

The Drugs You Use. By Austin E. Smith, M.D. 243 pages. Index. Price $3. New York: Revere Publishing Company, 1948.

The author's highly readable message is directed to the general public. He illustrates the abuse of medicines by the public with interesting examples and stresses the desirability of professional guidance. The functions of many of the public and private agencies which protect the consumer of drugs and cosmetics are explained.

The place for legitimate self-treatment is not adequately defined and the medical profession is pictured in a very favorable light. The dental chapter contains much useful information but the impression is given that so-called Vincent's infections are contagious, whereas evidence to support such a contention is inadequate.

The Drugs You Use may well be recommended reading for all dental patients. Those who are inclined to rely unduly on self-medication will derive maximum benefit from its perusal. The statistics cited by the author suggest that a large share of the public is not sufficiently critical in its attitude toward drugs.

Review of Dentistry for State Board Examinations. By Vincent R. Trapozzano, D.D.S. 661 pages. Index. Price $6.50. Philadelphia: W. B. Saunders Company, 1949.

Those dentists who wish to take state board examinations are fortunate in being able to get helpful information from three recent books, the latest of which is this one.

The subjects included in the various state board examinations are covered quite completely in the text and the material is well arranged. One chapter is devoted to each subject. Most of the contributors to the various chapters are well known authorities in the fields about which they have written. Among them are such men as: L. S. Fosdick, R. C. Wheeler, Paul Boyle, E. C. Dodds, J. A. Kolmer, H. B. G. Robinson, S. C. Miller, E. W. Skinner, J. C. Brauer and several others. Dr. Trapozzano, the editor of the book, also has prepared part of the section on prosthetics.

The book by R. M. Goepp, *Dental State Board Questions and Answers,* also published by Saunders and formerly widely used, has been out of date for several years and this new book is a welcome improvement.

The index is adequate but could be improved. The general format is satisfactory and judging by today's standards the price is reasonable.

This book, though intended primarily for those taking state board examinations, is also intended to serve as a general review for the undergraduate student and the general practitioner and can be heartily recommended.—*Josephine P. Hunt.*

Food Products. By Henry C. Sherman, Ph.D., Sc.D. Fourth edition. 428 pages. Index. Price $4.80. New York: The Macmillan Company, 1948.

Because food is the largest item in the cost of living and is a potent factor in health, its wise use should be promoted. With these reasons in mind, Dr. Sherman prepared this book to furnish subject matter for a broad general study of foods and food products.

This fourth edition has been substantially reduced in size, from 674 to 428 pages, without detracting from its value. The streamlining was accomplished by some excellent condensing, by eliminating a number of pictures and by omitting the tables of food composition.It has been almost entirely rewritten, so that most of the information is current. In only a few instances could one wish that more recent data were used. One such example is found in the use of figures compiled in 1912 and 1932 as a basis for the discussion of increased per capita sugar consumption.

Even though the actual discussions of some food products have been shortened, they are sufficiently comprehensive, while the references facilitate more detailed study of any subject the individual reader may desire.

Each food is discussed as to production, marketing, storage, standards of purity, general composition, followed by the special characteristics of digestibility, nutritive value and place in the diet. Although some parts are technical, there is sufficient simplification to make the volume of particular value to general readers.

The addition of a brief appendix on simple statistical treatment of research findings is in keeping with present scientific trends and is to be commended. Furthermore, it increases the value of the book as a text which is exceptionally well edited and free of typographical errors.—*Dorothea F. Radusch.*

An Introduction to the History of Dentistry. By Bernhard Wolf Weinberger, D.D.S. Cloth. 2 volumes. 922 pages, profusely illustrated. Index. Price $20. St. Louis: The C. V. Mosby Company, 1948.

This history, presented in two volumes, records the origin and evolution of dentistry from its early beginning down through the eighteenth century. Its author spent over forty years in compiling his data, much of which he obtained from libraries, museums and antiquarian societies in this and other countries. Readers will be impressed with the meticulous manner in which he has documented his material and with the fact that his painstaking research has uncovered new evidence on a few controversial subjects that will help correct some of the inaccuracies previously published. Throughout, the author has endeavored "to act as an interpreter or expositor of the best that has been thought and said upon the subject" rather than to set himself up as an authority. Despite the modest disclaimer most readers will conclude that Dr. Weinberger has established himself as an able historian.

Volume one, entitled "An Introduction to the History of Dentistry," deals with ancient and medieval dentistry and is divided into three parts. Part one, consisting of fifteen chapters, describes the art and practice of dentistry in ancient Egypt, Assyria, Phoenesia, Greece and Rome. The five chapters in part two deal with dentistry during the medieval and Renaissance periods and the three chapters in part three discuss the growth of dental literature, the advent of scientific dentistry and the practice of dentistry during the eighteenth century.

Volume two, entitled "An Introduction to the History of Dentistry in America," consists of seventeen chapters. It reviews American dentistry from the early colonial period to about 1825. It contains a fund of interesting biographical data, some previously unreported, on early American dental pioneers such as Baker, Woofendale, Revere, Gardette, the Greenwoods and others. One complete chapter is devoted to the dental problems of George Washington.

This book is a distinct contribution to history. It is well written and profusely illustrated. The text and paper are pleasing. The casual reader may find the contents too detailed but the student and historian will value and enjoy it.—*Lon W. Morrey.*

Dental Caries. By Kenneth A. Easlick, D.D.S. First edition. 234 pages with 32 tables and illustrations. Index. Price $5. St. Louis: C. V. Mosby Company, 1948.

This evaluation of the present scientific information on the cause and prevention of dental caries is the result of a workshop at the University of Michigan in September 1947. Participating in the conference were 114 persons with a variety of interests—private dental and public health practice, research, health education, dental education, biostatistics, nutrition, bacteriology, biochemistry and pediatrics.

The book contains nineteen presentations on various phases of the problem of dental caries by dental authorities from outstanding universities, research institutions, United States Public Health Service and American Dental Association. Six evaluating committees appraised the available data on dental caries, both that presented by the lecturers and discussants and that available in the literature.

The reports of the evaluating committees, which appear in the back of the book, concern particularly (1) the mechanism of the caries process, (2) the relationship of systemic conditions to the caries process, (3) the effectiveness of prophylaxis, toothbrushing, chewing gum, dentifrices and mouthwashes in the control of caries, (4) the utilization of fluorides and silver salts in the control of caries, (5) the relationship of ingested vitamins and minerals to dental caries, and (6) the contribution of various types of diet to caries control.

Excellent bibliographies, tables and figures contribute to a well organized volume in which the material is presented in easily understandable language.

The great worth of this book is in its evaluation of the control technics for dental caries and the comparison of their effectiveness. The conclusions presented by this competent group of scientific collaborators probably represents the best thought on the mechanism, prevention and control of dental caries. The book undoubtedly contains the most comprehensive review available on all phases of this problem. Out of conferences similar to the Michigan workshop, with continuing research and clinical application, much future progress may be made. This book is worthy of study by all interested in the control of dental caries.—*Allen O. Gruebbel.*

Dentistry for Children. By Joseph T. Hartsook, D.D.S., and Henry M. Wilbur, D.D.S. 75 pages. Appendix. Price $1. Tennessee State Dental Association (E. Jeff Justis, Secretary, Exchange Building, Memphis), 1947.

This manual was prepared to supplement the lecture material and clinical demonstrations which were presented to the dentists in the state of Texas during a postgraduate seminar on the subject of dentistry for children, and it contains sections on behavior management and child training, preventive dentistry, problems in growth and development, examination and diagnostic procedures, and treatment planning.

The section on behavior management and child training is a clear, concise statement in which the author stresses the importance of developing a proper routine for the child patient in his introduction to dental care.

The preventive dentistry section presents a concise program for caries prevention with the emphasis on dietary control, particularly as it pertains to carbohydrate restriction. It discusses also the inhibition of enzyme activity by substances topically applied, such as silver nitrate and sodium fluoride solutions.

In the section on growth and development as they pertain to the care of the child, the author discusses some problems involving the use of space maintainers and the effect of disturbances of normal growth and development, such as the ectopically erupting first permanent molar, on occlusion. Briefly discussed is the role of thumb and finger sucking, lip, cheek and tongue biting.

In the section devoted to examination and diagnostic procedures and treatment planning, the reader will find a routine for handling this phase of child care which shows the importance of first thoroughly cleaning the mouth before attempting to make a thorough clinical examination. Also emphasized is the importance of making an estimate of a just and adequate fee for the work to be done.

In the section on operative procedures it is pointed out that procedures are modified by the differences in the morphology between primary and permanent teeth. Preparation of cavities also is discussed.

Pulp management is discussed in a clear and concise manner in its section. Technics for the care of exposed pulp in primary and young permanent teeth are given and the reader will find it to his distinct advantage to give them careful consideration. The manual also contains a dietary program prepared by Philip Jay, of the University of Michigan. These are the same diets as presented in the literature by Dr. Jay but here they are presented in a form easy to read and, therefore, easy to prescribe.

I recommend this manual wholeheartedly to the practicing dentist. He will find it of great value in clarifying some of the many clinical problems which he encounters in the care of the child patient.—*George W. Teuscher.*

Personal and Community Health. By C. E. Turner, A.M., Ed.M., D.Sc., Dr. H. P. Eighth edition. Price $4. St. Louis: C. V. Mosby Company, 1948.

Since this book deals with factors in health other than those of the dental field and since there are persons in these fields who would feel the same about dentists commenting on their work as we feel about others assuming authority in ours, I shall confine my comments to Chapter Four, titled "Oral Hygiene."

The bibliography indicates that many of the statements made in this chapter are supported by competent dental authority but there are too many inaccuracies, inconsistencies and some folk-lore engendered beliefs. Such criticism, however, is not confined to this chapter because the same criticism usually can be made of articles and books written by members of the dental profession.

Throughout the chapter there are discrepancies in terminology such as the use of the term "premolar" in one sentence and the term "bicuspid" used elsewhere to indicate the same teeth. There also are inaccuracies like the one which states that: "The primary teeth serve as guides to help the permanent teeth erupt in their proper position. If primary teeth are lost too early this guiding function is apt to suffer." Competent orthodontic authorities do not subscribe to this theory.

In another paragraph it is strongly intimated that pain is the deciding factor in determining the amount of harm a tooth may be doing to the body and it stated at another point that there is "an appreciable difference in the hardness of the teeth of different persons," a statement in disagreement with the views of many authorities.

Mottled enamel or dental fluorosis is said

to be caused in localities "where the drinking water contains fluorine in a concentration greater than one part per million" while in reality one to one and a half parts per million of fluorine is recommended for water supplies. Portions of the chapter dealing with diet and nutrition, and caries formation also are in error.

These are but a few of the criticisms that could be directed at this chapter of the book and in my opinion this would not be a good textbook on health instruction to be used at the university level for which it was intended. —*Hugo M. Kulstad.*

Atlas of Dental and Oral Pathology. By Joseph L. Bernier and J. E. Ash. Fourth edition. 234 pages with 484 illustrations and 150 plates. Index. Price $7. Washington, D. C.: American Registry of Pathology, Army Institute of Pathology, 1948.

This fourth edition is a rather complete revision and the reproduction of photomicrographs is improved in many cases.

The new table of contents with the subject matter arranged in chapters in textbook fashion is an improvement.

The material covered is comprehensive and well selected. All the common oral lesions have been included as well as some of the rare ones. The inclusion of classifications such as the one for odontogenic tumors is a desirable addition.

Each chapter has several headings under which is a general discussion of the conditions to be illustrated by photomicrographs. In most instances the history and histologic description of each case has been eliminated in favor of a general discussion and the lack of these elements is a distinct disadvantage, preventing the Atlas from acting as a guide for the self-teaching of oral pathology. This should be a reference book for the novice as well as the professional and should therefore include detailed histologic description.

The chapter on dental caries is poorly written and is the weakest part of the book. The chapter is brief but brevity could be overlooked if the information available were accurate. Perhaps the chief reason for the poor quality of this section is reflected in the bibliography. Of the 14 references on dental caries only two are later than 1938 and only one of those is a major reference.

The remainder of the book is more accurately prepared and of much greater value, but in its present form the volume falls somewhat short of its anticipated and potential value as an aid to the teaching and practice of oral pathology.—*Donald Kerr.*

Outline of Histology. By Margaret M. Hoskins, Ph.D., and Gerrit Bevelander, Ph.D. Second edition. 291 pages with 148 illustrations, 2 in color. Two indexes. Price $3.50. St. Louis: C. V. Mosby Company.

In this edition, the authors have included what may be termed a new chapter on the oral cavity. The tongue, pharynx and nasal mucosa were the sections used in the first edition. This material has been rewritten to make a more detailed and complete account. To these items have been added descriptions of the lips, cheeks, gingivae, hard palate and glands of the oral cavity all of which are essential topics.

Another addition is found in the chapter on nervous tissue on the subject of responses and ten illustrations, two of them in color, serve to elaborate the pictorial portion of the book.

The other alterations in this edition are the rewriting of former content without adding or subtracting to the factual material. The exceptions to this statement may be found in the function of the reticular and areolar tissue, and in the introduction of a new term for a type of secondary dentin.

The book is a splendid addition to the busy practitioner's library as a reference, for it is concise, easily read and will furnish the reader an up-to-date outline of histology.—*J. Robert Schumaker.*

Physician's Handbook. By John Warkentin, Ph.D., M.D. and Jack D. Lange, M.S., M.D. Fifth edition. 293 pages with 25 illustrations. Index. Price $2. Palo Alto, Calif.: University Medical Publishers, 1948.

The rapid accumulation of new technics and procedures in clinical and laboratory medicine has greatly increased the number of details and facts which the physician must remember. The *Physician's Handbook* is a successful effort to provide a quick and convenient pocket reference on these subjects.

The first half of this volume is devoted to laboratory diagnosis, and is a comprehensive summary of technics and interpretations of laboratory tests. The fields of hematology, bacteriology, parasitology, biochemistry and serology are adequately covered within the space limitations.

The second section of the book contains a heterogeneous and unrelated collection of clinical facts and procedures whose common denominator is their property of eluding the memory of the student and practitioner of medicine. Such varied subjects as drug dosages, obstetrical measurements, stages of anesthesia, height and weight tables and cutaneous innervation are discussed. Frequent revisions have kept the book abreast of current developments in many fields.

This small volume continues to be an almost indispensable aid to all physicians, particularly to internes and residents who are called upon to perform and interpret many of the procedures described.—*Mary R. Richards.*

Surgical Pathology of the Mouth. By E. Wilfred Fish, M.D., L.D.S. 463 pages with 246 illustrations, 10 in color. Index. Price $10. London: Sir Isaac Pitman and Sons, 1948.

In the words of the author: "The form and content of this book are frankly vocational." It is "perhaps the story of general pathology as a dental man might see it. It cannot in the nature of things provide a very wide review of the general science, but is almost completely limited to those instances of cell degeneration, aberrations of growth and nutrition, inflammation and neoplasia which are of dental and oral interest."

The first six chapters deal with such general subjects as cell growth and degeneration, repair of the calcified matrix, circulatory disturbances, inflammation, chemotherapy and bacterial defense. An excellent introductory chapter discusses clearly and instructively many features of epithelium and tissues derived from the mesenchyme. The middle six chapters cover pathology of bone, dentin, dental pulp, cementum, enamel together with the enamel organ and the mucosa including the periodontium. The last four chapters are devoted to tumors and similar abnormalities.

It is regrettable that among the approximately 70 formal footnotes, not more than half a dozen are clearly of American origin. The text covering the relationship between fluorides and dental caries is based on the data supplied by Weaver obtained from two English communities, North and South Shields.

This is a valuable reference book in this field, even though it is definitely provincial. The illustrations are excellent and each chapter is followed by a very helpful summary. The publisher's workmanship is of a very high quality.—*Edward H. Hatton.*

A Clinical Manual of Operative Dentistry. Edited by Robert O. Green, D.D.S. 200 pages with 265 illustrations. Price $5. Dubuque, Iowa: William C. Brown Company.

The first edition of this manual is designed primarily for students who, having completed the technical courses, are entering upon the clinical phases of instruction in operative dentistry. The book is divided into the following five sections on amalgam, silicate, gold foil, inlays and pulpal therapy. Twenty-five contributors associated with the School of Dentistry of the University of Minnesota, have assisted in this work under the editorial guidance of Dr. Green.

This work could well be considered a text book if the clinical pathology of the hard tissues of the teeth were included. It is, however, strictly technical in nature and is properly classified as a manual, containing many excellent illustrations which should be helpful to the student in learning the management of both typical and atypical cavity preparations.

Each phase of clinical operative dentistry has been carefully considered by men who have taken a special interest in certain divisions of this field. The principles of cavity preparation follow closely the Black system and, as a matter of fact, all of the described technical procedures, aside from being well presented, are sound in principle and readily adapted to practice.

This manual can be recommended both for the student and the general practitioner who may desire a ready reference or a review on the fundamentals of good operative procedures. The reviewer regards this work as the most up-to-date and one of the best available presentations of its kind on clinical operative dentistry.—*Arne F. Romnes.*

CASES AND COMMENTS

Leukopenia and Delayed Healing after Roentgen Therapy for Lymphosarcoma: Report of a Case. By Louis Willinger, D.D.S., New York.

A white male textile executive, aged 46, presented himself at the office on May 24, 1948. He was extremely nervous and in much pain. His complexion was clammy and yellowish. The family physician revealed that the patient had received radiation treatment for the past two years for lymphosarcoma. Two weeks previously his dentist extracted the lower right central incisor, lower left central and lateral incisors, cuspid, first and second bicuspid. Since then the patient had been receiving penicillin for what the physician diagnosed as a submaxillary cellulitis. During the two week period of cellulitis treatment the patient received sedation without much relief from pain.

Clinical examination revealed evidence of the extractions and a spreading of the investing alveolar process. In the left first and second molar region up to the mesial aspect of the lower left third molar lingually there was an irregular lesion of sloughing soft tissue extending from the crest of the ridge to the floor of the mouth. The bone of the lingual aspect of the body of the mandible was exposed. The lower left third molar appeared to be loose.

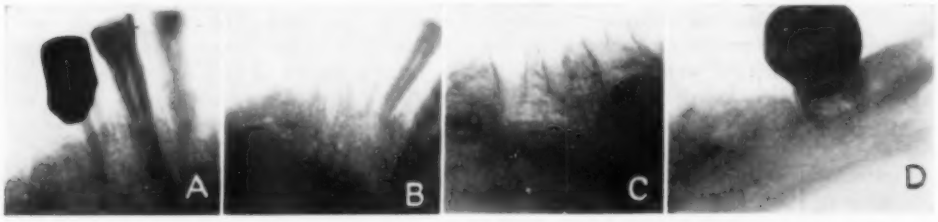
A full mouth roentgen examination disclosed a generalized periodontoclasia involving most of the teeth. The lower left cuspid was unerupted and impacted. Regeneration in the region of the recent extractions was incomplete (see Illustration). There was no roentgenographic evidence of bone necrosis in the lower left first and second molar region.

In January a blood count of the patient was reported normal.

After the clinical and roentgen examination the patient's physician was again contacted and it was suggested that another complete blood examination be made. At this time it was extremely important to institute therapy to give the patient some relief from pain.

The involved region was cleansed with a weak solution of hydrogen peroxide. The soft tissue lesion was dried and painted with Churchill's tincture of iodine followed by the application of a 10 per cent solution of silver nitrate, thus forming a silver iodide coating on top of the iodine. Instructions were given to insufflate the painful region with orthoform powder as often as requested, and a high caloric diet was suggested.

On May 25 improvement was noticeable. The same treatment was given on May 26 with the addition of penicillin powder insufflation over the denuded area. On May 27 the lesion was again irrigated with a warm peroxide solution, iodine and silver nitrate were applied. Improvement continued. On May 28 the patient complained of recurrent pain. The treatment was the same as on previous visits. On June 1 the treatment was repeated. Signs of



A: Lower right cuspid, right first bicuspid and right lateral incisor. Some resorption of investing alveolar structure is visible. Right first bicuspid is covered by ill-fitting gold crown. B: Region reveals evidence of recent extraction of right and left central and left lateral incisors. Right lateral incisor shows considerable resorption of investing alveolar structure. C: Lower left cuspid region reveals unerupted tooth. Left biscuspid region shows sockets where teeth have been removed, and sharp bony edges of the alveolar ridge. D: Lower left third molar

soft tissue regeneration appeared on the denuded bone surface. On June 5 tissue regeneration was complete and there was no evidence of exposed bone. At this date a blood examination showed: hemoglobin 71 per cent; red blood cells 3,900,000; white blood cells 1,200; platelets 130,000; promyelocytes 1 per cent; myelocytes neutrophil 2 per cent; polymorphonuclear leukocytes, non-segmented, 0 per cent; polymorphonuclear leukocytes, segmented, 10 per cent; lymphocytes 59 per cent; monocytes 28 per cent.

The blood picture was suggestive of toxic depression as a result of roentgen therapy. Bleeding time 3 minutes; coagulation time 5 minutes; clot retraction present; tourniquet test negative; prothrombin time 19 seconds; prothrombin control 17 seconds, index 89 seconds.

It would be considered unwise to perform any minor operations such as extractions of teeth during this period. Likewise, roentgen therapy should not be given until there is definite improvement in the blood picture.

As the patient improved there was improvement in the patient's mental attitude. He was free from pain. The patient was worried from the onset of his illness. He felt there was a close relationship between the oral condition and the glandular swellings.

Since it was necessary to remove the upper left first bicuspid and lower left third molar another blood examination was made on June 16 which disclosed: hemoglobin 64 per cent; red blood cells 4,220,000; white blood cells 5,200; platelets 90,000; polymorphonuclear leukocytes, non-segmented, 11 per cent; polymorphonuclear leukocytes, segmented, 51 per cent; lymphocytes 32 per cent; monocytes 6 per cent.

On June 19 the upper left first bicuspid was extracted, the region was curetted and an iodoform gauze dressing was placed within the socket. On June 25 the lower left third molar was removed and the region was curetted gently. Postoperative care was the same as before. Healing continued uneventfully and on July 6 the patient was dismissed.

On October 4 the patient had a relapse of his lymphosarcoma condition. All symptoms point to an early fatal termination.

Summary

This particular case is of special interest because the teeth were extracted in the presence of a condition of marked leukopenia accompanied by a slight thrombocytopenia with a moderate degree of anemia. The pathologic condition of the blood was the result of the radiation therapy the patient had been receiving. Trauma during the extractions caused the tissue sloughing. Due to a diminution of the white blood cells healing was delayed. The local therapy in combination with the supportive treatment increased the white cell count and helped the regeneration of the broken down tissue.

The patients who give a history of having received radiation therapy require a complete blood examination before extraction of teeth or any other surgical procedure. The family physician at all times should be sought for consultation and cooperation.—*355 East 149th Street.*

CURRENT LITERATURE

Serial Study of Occlusion (Birth to Ten Years of Age). J. H. Sillman. Am. J. Orthodont. 34:12, Dec. 1948.

This paper presents a serial study of occlusion and some suggestions on preventive orthodontics. The material is drawn from serial casts of more than fifty children whose occlusion was recorded continuously from birth, some for ten years.

The study of occlusion should include the predental phase, changes of dental arch relation, anatomic changes, morphologic changes and changes of occlusion. This dynamic process of development should be a part of dental education, so that a more mature concept of prevention may find its way into dental practice.

Occlusion is first noted prior to the eruption of the incisors. At birth the mandibular gum pads are posterior, and they progressively move forward until the first deciduous molars erupt. At this time the relative anteroposterior relation of the dental arches is established. If the child has the potentiality of developing "good" occlusion, little change is noted in the anteroposterior relation of the dental arches due to premature loss of deciduous teeth. However, if occlusion potentialities are "poor," changes are noted. Sometimes spot grinding will aid in eliminating defects.

Occlusion and all the anatomic landmarks of the dental arches are constantly changing, and periodic observation is necessary in order to understand the individual variation of development. The importance of dental care for all teeth (deciduous and permanent), so as to maintain arch continuity, cannot be overstressed in rendering a service in preventive orthodontics.—*William F. Ford.*

A New and Easy Way of Taking Profile Photographs. Clifford L. Whitman. Am. J. Orthodont. 34:980, Dec. 1948.

Photography as a recording and diagnostic aid in orthodontics can be of inestimable value, but results have often been poor. A plastic "profilator" was devised which orients the patient's Frankfort and orbital planes to the focal plane of the camera by means of two openings in the plastic through which background light may be seen if properly related.

A camera with a lens of long focal length should be used. Because improper illumination will ruin a photograph, a clear and concise description of proper lighting is presented.

A Biologic Approach to Orthodontics. Norman Gray. A. J. Orthodont. 34:12, December 1948.

In studying the efficient function of dental arches, the first consideration is the relation of the crowns of the teeth. Occlusion can be grouped under three headings: (1) hypothetical, (2) typical and (3) normal.

The purpose of orthodontics is not to make the dentures of all conform to a mathematical standard; its purpose is to assist nature in the development of the jaws and associated parts, and to harmonize the teeth and supporting parts in such a manner that the whole masticatory apparatus will best achieve full functional activity. This does not necessarily mean perfection in the surface relations of the teeth.

Awareness of the presence of inherited characteristics or the lack of growth principles will prevent dentists from mechanically treating patients that are beyond such assistance. The biologic point of view forces recognition of the degenerate tendencies of the human jaw and the realization that in some cases extraction of teeth is necessary.

When malocclusion has been corrected, every effort should be made to ensure normal function of the surrounding parts. This in general is a matter of careful nutrition; correction of faulty habits; exercises to improve the nerve and muscle tone of the face and lips; breathing exercises for nose and sinuses, palatal bone and dental arches, and general exercises for posture of head and chest.—*William F. Ford.*

Inlays and Fixed Bridgework. George J. Anderson. New England D. J. 1:24, Jan. 1948.

The author describes the principles and methods associated with the construction of inlays and fixed bridgework. A prerequisite for a good inlay is a properly prepared cavity, free from undercuts. The box form, the slice lock form and a combination slice and box form of

preparation have their places in inlay bridge construction. Acrylic inlays are to assume an important but limited place in operative procedures.

Before taking an impression, the cavity should be dried and coated twice with varnish in order to block the dentinal tubules from bacterial invasion. The direct wax pattern method —under favorable operating conditions—is preferable to the indirect method.

A good inlay has proper contour and contact, no gingival overhang or discrepancy, complete marginal contact throughout and correct occlusal form. It functions without trauma and does not discolor in the mouth. To produce correctly fitting castings, the wax pattern must be carved exactly to the margins or the matrix band must be trimmed and its modeling compound released exactly at the margins.

Of primary importance in fixed bridgework are (1) form of cavity preparation; (2) parallelism, which is fundamental in seating the bridge properly; (3) accurate fit of attachments; (4) adequate root support of abutment teeth; (5) adequate retention (sometimes teeth next to abutment teeth on both sides of the span should be employed); (6) correct tooth form; (7) good occlusion; (8) gold of adequate strength, and (9) correct cementation. —*James Springer.*

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The Editor's Viewpoint.—95.
*Pulp Healing. R. L. Glass and H. A. Zander, Tufts College Dental School.—97.
*Maintenance of Equilibrium in Reversible Hydrocolloid Impressions. I. Made With Stock Impression Materials. Allison G. James, Beverly Hills, Calif.—108.
*Maintenance of Equilibrium in Reversible Hydrocolloid Impressions. II. Made With Materials Supplied by the Manufacturers for Testing. Allison G. James, Beverly Hills, Calif.—119.
The Effect of Wetting Agents on Oral Lactobacilli. II. Local and Systemic Toxicity in Mice. Toxicity vs. Antibacterial Activity. Frank E. Walter and Harve J. Carlson, Western Reserve University.—124.
*Dental Caries in the Syrian Hamster. V. The Effect of Three Different Fluoride Compounds on Caries Activity. Paul H. Keyes and Kanwar L. Shourie, University of Rochester and the Harvard School of Dental Medicine.—138.
*The Influence of the Blood Calcium Level Upon the Action of Fluorine in Predentin and Dentin Formation. J. T. Irving, University of Cape Town, Union of South Africa.—144.
*Inhibitory Effect of Fluoride on Tooth Decalcification by Citrate and Lactate in Vivo. I. Zipkin and F. J. McClure, National Institute of Dental Research, National Institutes of Health, Bethesda, Md.—151.
Substances Capable of Decreasing the Acid Solubility of Tooth Enamel. R. S. Manly and B. G. Bibby, Procter and Gamble Company and Tufts College Dental School.—160.
*Experimental Effects of Thiouracil and Selenium on the Teeth and Jaws of Dogs. James A. English, Naval Medical Research Institute, Bethesda, Md.—172.
*The Aspect of the Bands of Schreger in the Horizontal Sections of the Enamel. Jorge Erausquin, Universidad de Buenos Aires, Argentina.—195.

Pulp Healing. R. L. Glass and H. A. Zander.

The pulps of healthy young human teeth (to be extracted for orthodontic purposes) were exposed and covered with pastes of calcium hydroxide and water or zinc oxide-eugenol. The teeth were extracted at intervals varying from 24 hours to 12 weeks, and prepared for histologic sections. Within 24 hours, pulps treated with calcium hydroxide showed a superficial region of necrosis demarcated from healthy tissue by a linear basophilic zone. After two weeks, a layer of primitive dentin had been formed against this basophilic zone. Within four weeks, new odontoblasts were formed and new dentin was deposited against the primitive type to complete the healing process. The healing observed under calcium hydroxide is remarkably free of inflammation.

No healing occurred in exposed pulps treated with zinc oxide-eugenol. After 24 hours, an area of hemorrhage and acute inflammation was seen. The inflammation became chronic and granulation tissue formed at the site of the exposure.

Maintenance of Equilibrium in Reversible Hydrocolloid Impressions. I. Made With Stock Impression Materials. Allison G. James.

Three molar porcelain tube teeth were pre-

pared for a mesio-occlusal inlay, a three-quarter crown, and a mesio-occluso-distal inlay with a distolingual veneer. Accurately fitted hard dental gold castings were made for these preparations, which were mounted in stone in display rings. Specially constructed, straight-sided, perforated impression trays of standard size were made. A weighted block with receptacle to receive the display ring insured a similar amount of impression material for all subsequent impressions made of the porcelain preparations. The fit of the test castings to dies poured in such impressions was the criterion for accuracy of the impression material. Impressions of each preparation were made and poured immediately; another series was made and poured after 15 minutes' storage in water or 2 per cent potassium sulfate. The dies from these series acted as controls.

Two stock reversible hydrocolloid impression materials were tested. One was found to contract at a critical point of time after making the impression. This produced an oversized die. Accuracy with this material could be maintained only up to three hours' storage in either 2 per cent potassium sulfate or tap water after making the impression. The second material expanded and produced an undersized die, even when poured immediately, but very noticeably when stored in tap water for 15 minutes before pouring.

All hydrocolloid impressions should be poured immediately. Under no circumstances should they be placed in solutions or wrapped in wet cloths and sent to commercial laboratories for pouring. Immersion in potassium sulfate solution does not maintain them in equilibrium any more than immersion in water after the critical end point has been reached.

Maintenance of Equilibrium in Reversible Hydrocolloid Impressions. II. Made With Materials Supplied by the Manufacturers for Testing. Allison G. James.

Four reversible hydrocolloid impression materials supplied by manufacturers were tested by the procedure described previously. Two materials were tested for maintenance of equilibrium both in 2 per cent potassium sulfate solution and in tap water. Equilibrium was maintained longer in the latter. Two materials were tested in water alone as recommended by the manufacturers.

Three of the materials contracted at the critical end point of time and produced oversized dies thereafter. One of the materials expanded and produced undersized dies on immediate pouring and after 15 minutes' storage in water. Tests show that complete accuracy is possible only if hydrocolloid impression material is properly handled and that all impressions should be poured immediately if possible, and never after the critical point established for the material used.

Dental Caries in the Syrian Hamster. V. The Effect of Three Different Fluoride Compounds on Caries Activity. Paul H. Keyes and Kanwar L. Shourie.

The effect of three fluoride compounds of different solubility on dental caries in hamsters was studied on the hypothesis that the posteruptive caries-inhibiting effect of the fluorides might be related to the availability of the fluoride ion. An attempt was also made to obtain information on a posteruptive systemic effect from fluoride administered parenterally.

Under the conditions of this experiment 50 ppm. of fluoride, as sodium fluoride added to food and water, was very effective in reducing caries activity in the molars of hamsters; sodium fluorosilicate was somewhat less effective, and calcium fluoride was essentially ineffective.

Hamsters do not appear to be well suited for study of the posteruptive systemic pathways of fluoride action on caries activity because of contamination of the oral cavity with urine and feces.

The Influence of the Blood Calcium Level Upon the Action of Fluorine in Predentin and Dentin Formation. J. T. Irving.

The effect of fluorine on dentin formation in the rat incisor was studied in high calcium-low phosphorus rickets after the serum calcium level was temporarily lowered by starvation and in low calcium rickets after the serum calcium was temporarily elevated by administration of vitamin D.

The experiments showed that if the blood calcium was low at the time of the injection of fluorine, the experimental dentin line calcified prematurely, shortly after the fluorine was given. If the blood calcium was normal, the predentin forming at the time was affected by the fluorine but did not become hypercalcified until spontaneous calcification occurred.

Inhibitory Effect of Fluoride on Tooth Decalcification by Citrate and Lactate in Vivo. I. Zipkin and F. J. McClure.

It was shown that as little as 1 ppm. fluorine inhibited the erosion produced in rats' molars by 0.25 normal sodium citrate at pH 6.3 to 6.5 when incorporated in the citrate and administered to the rats as the sole source of drinking fluid. Fifty parts per million fluorine was no more effective in inhibiting erosion than 5 ppm.

Although fluoride injected intraperitoneally was effective in reducing the erosion caused by citrate, about 25 times more fluoride was necessary to give the same effect as 1 ppm. fluorine administered orally. Analysis of the rats' incisors and molars showed that although approximately five times more fluorine was incorporated in the teeth of the rats receiving 50 ppm. than in those receiving 5 ppm., the degree of inhibition produced was the same. Hence it appears that the degree of inhibition of erosion by fluoride is not related to its concentration in the dental tissues.

Fifty parts per million fluorine was no more effective than 5 ppm. in reducing the erosion produced by 0.25 normal lactate solutions at pH 3.0 to 3.2 when incorporated in the latter and administered to the rats as the sole source of drinking fluid. As little as 1 ppm. fluorine was effective in reducing the erosion produced by 0.25 normal lactate solutions at pH 4.5, and maximum protection against erosion was produced at 2.5 ppm. fluorine. Fluorine injected intraperitoneally was ineffective in reducing the amount of erosion produced by lactate at pH 3.0.

Experimental Effects of Thiouracil and Selenium on the Teeth and Jaws of Dogs. James A. English.

References are to be found in the literature pertaining to toxic effects of thiouracil when it is used clinically; similarly, selenium is reported to be toxic when it occurs in the soil and vegetation, as is the case in certain western states. No published accounts of experimental work have been found relating either of these substances to possible oral manifestations.

In this study, dogs of the same litter were treated daily with one of the following doses, per kilogram of body weight: 25 mg. organic selenium, 5 mg. organic selenium or 5 mg. thiouracil. Changes observed in the dentition and jaws were: (1) hypoplasia of enamel in the dog treated with thiouracil, (2) structural defects of dentin in the dog receiving the large dose of selenium, (3) structural changes in mandibular supporting bone in both of these dogs and (4) marked variation in the size and shape of mandibular condyles of all dogs treated, with early discontinuation of condylar bone formation in selenium-treated dogs.

Both thiouracil and selenium are believed to have an inactivating effect on enzymes concerned with metabolic processes. It may be through endocrine disturbances that these substances affect tooth development; however, it is also possible that the structural and gross defects noted are due to direct toxic effects. The gross lesions in these dogs are not unlike those found experimentally in thyroidectomy or in human cretinism. Histologically, sections show lesions that are similar to those found in nutritional disorders or in diseases that are essentially of a metabolic or endocrinologic nature.

The Aspects of the Bands of Schreger in the Horizontal Section of the Enamel. Jorge Erausquin.

The bands of Schreger correspond to a horizontal double curvature of the prisms in the inner two thirds of the enamel in the lateral plates. This double curvature involves a complete ring of enamel. In different rings, the deviation is to the left or to the right, alternately.

These enamel rings are not completely flat, but rather are slightly conic. For that reason a horizontal section cut through two or three of these bands shows concentric rings with the alternate deviation to the right and to the left.

LIST OF DENTAL OFFICERS

SEPARATED FROM ARMY DENTAL CORPS

THE following list of dental officers separated from the Army Dental Corps does not include rank because such information is no longer furnished by the Surgeon General's Office. Publication will be given to other names as soon as possible.

Alabama	
Aliceville	Parker, George S.
Talladega	Robinson, Dabney P.
Arizona	
Mesa	Conant, Jess A., Jr.
California	
Los Angeles	Carlson, Robert D.
Sacramento	Buell, Robert A.
Sacramento	Driemeyer, Edward F.
San Francisco	Aylsworth, Donald W.
San Francisco	Gugliemi, Siro E.
San Francisco	Lee, David L.
Santa Maria	Reiner, Philip C.
Colorado	
Denver	Jersak, Robert C.
Denver	Lanning, Robert G.
Ft. Collins	McNutt, John H.
Connecticut	
Bridgeport	Grogan, David F.
Colchester	Schnader, Yale E.
Hamden	Bershtein, David B.
Hartford	Cohen, Edward
Hartford	Zak, Raymond J.
New Britain	Fletcher, Walter R., Jr.
New Britain	Kania, Henry S.
New Haven	Sabin, George, Jr.
Torrington	Novey, Ernest E.
Waterbury	Nardozza, Leonard
District of Columbia	
Washington	Crawford, St. Elmo W.
Washington	Hagen, Stanley E.
Florida	
Jacksonville	Becker, Melvin L.
Lakeland	Fillastre, Alvin J., Jr.
Tampa	Ficarrotta, Joseph R.
Georgia	
Atlanta	Smithloff, Milton
Dublin	Moore, Robert L.
Springfield	Mingledorff, Ernest B.
Idaho	
Priest River	Kondo, Mark M.
Illinois	
Aurora	Lies, Donald M.
Chicago	Eisman, Morris P.
Chicago	Erickson, Forrest E.
Chicago	Filippini, Victor P.
Chicago	Homer, Melvin
Chicago	Johnston, Thomas S.
Chicago	Kroll, George
Chicago	Krvavica, John A.
Chicago	Krzeminski, Bronislaus S.
Chicago	Mencarow, Robert P.
Chicago	Mintzer, Herman
Chicago	Panick, Robert
Chicago	Penefsky, Morris
Earlville	Genter, Frank J.
East St. Louis	Prosser, Thomas E., III
Galesburg	Cole, Robert J.
Glen Ellyn	McNeill, Dean S.
La Grange	Randolph, Robert G.
Oak Park	Cerney, Alan J.
Pecatonica	Schnell, Richard J.
Rockford	Hoffman, Richard L.
Westmont	Fierce, Francis M., Jr.
Indiana	
Berne	Sprunger, Edgar P.
Charlestown	Bagby, Paul R.
Chesterton	Neeley, Shirley K.
Fort Wayne	Allen, Robert D.
Indianapolis	Robertson, Sidney E., Jr.
Terre Haute	Elliott, Emrich E.
Iowa	
Council Bluffs	Larson, Gerald P.
Logan	Boies, William A.
Kansas	
El Dorado	McCully, Albert C.
Wichita	Alexander, William F.
Kentucky	
Holland	Seay, Joe H., Jr.
Louisiana	
Hammond	Mochetta, Thomas B.
Maine	
Houlton	Rogers, Frank P.
Waterville	Nawfel, Elias R.
Waterville	Poirier, John E.
Maryland	
Baltimore	Feindt, Frederick H.
Takoma Park	Paulson, Robert A.

Massachusetts

Attleboro	Baker, Charles R.
Blackstone	McCooey, James H.
Bradford	Murphy, Robert J.
Brightons	Reinhalter, Norman W.
Brookline	Gallagher, Joseph E.
Brookline	Schwartz, Stanley M.
Cambridge	Andell, Melvin A.
Chicopee Falls	Kapinos, Frederick
Everett	Divalo, Henry J.
Framingham	Carchio, John J.
Lawrence	Boscketti, Carl L.
Lawrence	Schmidt, Raymond J.
Medford	McNeil, John F.
Melrose	Graf, William H.
Methuen	Hyde, Kenneth R.
New Bedford	Abesh, William
North Easton	Tait, Robert H.
Somerville	Henderson, George F.

Michigan

Detroit	Moss, Leslie I.
Saginaw	Kelly, Donald L.

Minnesota

Duluth	Scalon, John F.
Minneapolis	Carlson, Robert O.
Minneapolis	Larson, James W.
Northfield	Brown, Edwin L.
St. Paul	Cohen, Edward L.
St. Paul	Johnson, Robert A.
St. Paul	Jones, Kent W.
St. Paul	Liedl, Alphonso J.
St. Paul	Nienaber, William B.

Mississippi

Holly Springs	Sandusky, Walter C., Jr.

Missouri

Clayton	Burstone, Marvin S.
Clayton	Zotos, Gregory C.
Kansas City	Gans, Benjamin
Kansas City	Hailey, Ray, Jr.
Maplewood	Peters, George W., Jr.
Monett	Stocker, William B.
Neosho	Sale, Onal C.
St. Louis	Henrick, Harold W.

Nebraska

Omaha	Guilfoyle, William J.

New Jersey

East Orange	Vincent, Gordon R.
Highland Park	Kahn, Stuart L.
Jersey City	Kay, Irving B.
Long Beach	Filice, Francesco E.
Mt. Ephraim	Balestra, Lawrence F.
Newark	Eisenberg, Mervin
Newark	Feldman, Seymour
Newark	Hirschberg, Alvin
Newark	Landes, Richard S.
South Orange	Schnur, Victor M.
Upper Montclair	Freeman, Gordon M.

New York

Bronx	Esposito, Ralph M.
Bronx	Jaffee, William
Bronx	Konsens, Herbert J.
Bronx	Lefkowitz, Laurence S.
Bronx	Lusig, Harvey
Bronx	Saracino, Savino F.
Brooklyn	Abrams, Abraham
Brooklyn	Adelman, Herbert S.
Brooklyn	Apton, Lewis K.
Brooklyn	Costa, Rosario J.
Brooklyn	DeSimone, Vincent G.
Brooklyn	DeVito, Joseph J.
Brooklyn	Fell, Stanley C.
Brooklyn	Green, Jacob
Brooklyn	Kafer, Joseph E.
Brooklyn	Karnoff, Elias M.
Brooklyn	Karr, Steven
Brooklyn	Markus, Werner L.
Brooklyn	Marten, Milton A.
Brooklyn	Mendelson, Jason Z.
Brooklyn	Milgram, Nathan
Brooklyn	Mitnick, Morton B.
Brooklyn	Numeroff, Seymour G.
Brooklyn	Roseman, Harold
Brooklyn	Saren, Paul
Brooklyn	Semler, Sidney
Buffalo	Dispenza, Anthony T.
Buffalo	Krutchick, David
Buffalo	Milks, Robert F.
Dunkirk	La Paglia, Vincent J.
Ft. Washington	Collings, Donald R.
Jackson Heights	Kinney, William B., Jr.
Kingston	Bushnell, George F.
Lockport	Castle, William E.
Lockport	Wallace, William G.
Long Island	Giardina, Charles H.
Manhasset	Lutz, William E.
Manhasset	Smith, Roger F.
Middle Village	Buckstein, Herman
Monroe	Goldblatt, Jacob
New York	Barish, David M.
New York	Bloom, Bernard D.
New York	Cinnapko, Victor P.
New York	Cohen, Lester
New York	Greenberg, Martin
New York	Halpert, Wesley
New York	Herz, Jerome J.
New York	Kirsch, Sanford
New York	Lewis, Leon
New York	Murano, Alfieri F.
New York	Perrotta, Frank J.
New York	Piro, John D.
New York	Rothkowitz, Roger H.
New York	Schwartzburg, Ephraim S.
New York	Severns, Byren S.
Niagara Falls	Caterina, Guy P.
Olean	Eddy, John H.
Port Henry	Henry, Douglas
Riverdale	Arden, Howard A.
Rochester	Bonafede, Joseph M.
Rochester	Manuele, Joseph T.
Rockville Centre	Levien, Lester B.
St. Albans	Dudas, Walter J.
Solvay	Ascioti, Dominick J.
Syracuse	Malfitano, Anthony A.

North Carolina

Rocky Mount	Large, Nelson D.
Statesville	Lazenby, Glenn A., Jr.
Statesville	Little, James E.

Ohio

Bexley	Kessel, Stanley
Cincinnati	Allen, Joseph M.
Cleveland	Finck, Morris
Cleveland	Rosen, Morton S.
Coldwater	Ensign, Hoyt M.
Columbus	Norman, Stanley K.
Columbus	Speer, MacDonald, Jr.
Dayton	Rubin, Frank
Lakewood	Krueger, Donald G.
Niles	Altiero, Anthony J.
Sylvania	Burnes, Robert F.
Wellston	Essman, Paul J.

Oklahoma

Bristow	Owen, Robert C.
Edmond	Olson, Arthur L.
Oklahoma City	Ritchie, James R.
Tulsa	Russell, Edmund W., Jr.

Oregon

Portland	Weiss, Richard E.
Vale	Kondo, Roy J.

Pennsylvania

Allentown	Goldstone, Joseph
Ardmore Park	Felice, John R.
Chester	Ruffini, John A.
East Lansdowne	DeRevere, Robert E.
Erie	Horstkotte, Edward H., Jr.
Philadelphia	Amorosi, Anthony F.
Philadelphia	Cooperman, Harry N.
Philadelphia	Frost, Manuel
Philadelphia	Kaufman, Irving J.
Philadelphia	Mondros, Allen E.
Philadelphia	Simkins, Irwin L.
Pittsburgh	Kimel, Abraham F.
Pittsburgh	Stiff, Robert H.
Oakmont	Donaldson, John H.

Puerto Rico

Aguada	Lopez-Soto, Agustin

Rhode Island

Norwood	Confreda, Pasquale V.
Providence	Garber, Martin A.
Providence	Nelson, Eugene M.
Warren	Paquin, Normand O.

South Carolina

Pendleton	Horton, Thomas M.

South Dakota

Mitchell	Kaapenman, James W.
Mitchell	Krause, LeRoy P.

Tennessee

Etowah	Munger, Gorman F.
Memphis	Hall, Frank J.
Memphis	Hedges, Posey G., Jr.
Memphis	Sigman, Ernest H., Jr.
Mt. Pleasant	Dunnebacke, Fred H.
Nashville	Graves, Charles W., Jr.
Nashville	Hill, Elmore
Sheakleyville	May, Lawrence H.

Texas

Amarillo	Cross, James J.
Anson	Baker, John C.
Childress	Nabers, Claude L.
Dallas	Campbell, Billy
Dallas	Emerson, Harold H.
Houston	Speck, Norman T.
Houston	Wise, Bernard I.
Kingsville	Chandler, Cecil C.
Pelly	Waldrep, Alfred C., Jr.
Terrell	Cozart, Robert C.

Utah

Salt Lake City	Duffin, Richard G.
Salt Lake City	Lund, George C., Jr.
Salt Lake City	Sperry, Edmund T.

Vermont

Bristol	Norton, Robert A.

Virginia

Charlottesville	Ross, Welford W.
Evington	Hughes, Porter A.
Kents Store	Perkins, Charles K.
Mathews	Gillespie, William N.
Portsmouth	Hill, Gladstone M.
Portsmouth	Skeppstrom, Eugene, Jr.

Washington

College Place	Huber, Harold S.
Seattle	Kraft, Harry J.

West Virginia

Beckley	Newman, James E.
Montcoal	Kilgus, Donald J.

Wisconsin

Milwaukee	Mayer, Hugh C.

DEATHS

Blome, Albert H., Peoria, Ill.; Dental School, Northwestern University, 1905, died April 18; aged 65.

Brann, Albert, Sweetwater, Texas; Texas Dental College, 1913; died March 6; aged 62.

Capron, Winfield B., Utica, N. Y.; School of Dentistry, University of Buffalo, 1903; died May 4; aged 68.

Chipp, Elvin D., Kingston, N. Y.; Philadelphia Dental College, 1900; died April 22, aged 76.

Crymes, Thomas G., Greenville, S. C.; Pennsylvania College of Dental Surgery, 1896; died April 12; aged 76.

Davis, Henry S., Cincinnati; Ohio College of Dental Surgery, University of Cincinnati, 1915; died April 22; aged 59.

Donaldson, H. N., Bellevue, Ohio; Pennsylvania College of Dental Surgery, 1891; died in April; aged 79.

Donlan, Andrew F., Waltham, Mass.; Tufts College Dental School, 1909; died April 27; aged 70.

Ellis, Carson E., Auburn, Wash.; Dental School, Northwestern University, 1905; died April 12; aged 71.

Greene, James, New York; died April 11; aged 50.

Gsantner, Otto A., Omaha; Omaha Dental College, 1902; died January 31; aged 73.

Guilford, Dudley, Haverford, Pa.; Philadelphia Dental College, 1903; died March 31.

Gunn, William W., Columbus, Texas; School of Dentistry, University of Louisville, 1915; died March 23; aged 58.

Haberman, Lawrence M., New York; Ohio College of Dental Surgery, University of Cincinnati, 1919; died April 4.

Hafner, Theodore F., Mokane, Mo.; School of Dentistry, Washington University, 1905; died April 18; aged 78.

Hardy, John R., Menlo Park, Calif.; College of Dentistry, University of California, 1895; died February 6; aged 79.

Harmony, Frederick A., Millersburg, Ohio; College of Dentistry, Ohio Medical University, 1905; died February 20; aged 72.

Harrold, G. Floyd, Elwood, Ind.; School of Dentistry, Indiana University, 1923; died April 12; aged 54.

Hart, Terry M., St. Louis; The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1913; died March 15.

Haskell, George W., Minocqua, Wis.; School of Dentistry, Marquette University, 1903; died March 9; aged 67.

Hawk, Harry E., Ironton, Ohio; College of Dentistry, Ohio Medical University, 1902; died February 15; aged 74.

Hazlett, James G., Seattle; School of Dentistry, North Pacific College of Oregon, 1918; died February 13; aged 72.

Heatwole, Timothy O., Baltimore; University of Maryland, School of Dentistry, and the Baltimore College of Dental Surgery, 1895; died April 28; aged 84.

Heidenreich, John C., Bicknell, Ind.; Indiana Dental College, 1911; died March 30; aged 62.

Held, Julius H., Portland, Ore.; School of Dentistry, North Pacific College of Oregon, 1918; died March 14; aged 62.

Henry, George W., Los Angeles; College of Dentistry, University of Southern California, 1918; died April 18; aged 59.

Henselmeier, Erwin, Los Angeles; School of Dentistry, Washington University, 1909; died February 6; aged 59.

Herkenroth, Herbert W., Seattle; died February 9; aged 54.

Hill, David B., Salem, Ore.; School of Dentistry, University of Denver, 1912; died January 25; aged 62.

Hill, George L., Sr., Wheeling, W. Va.; Cincinnati College of Dental Surgery, 1900; died February 16; aged 69.

Hinkle, Joseph L., Mount Carmel, Pa.; School of Dentistry, University of Pittsburgh, 1933; died March 23; aged 40.

Hoke, Leslie L., Fulton, N. Y.; School of Dentistry, University of Pennsylvania, 1918; died January 20.

Howard, Charles T., Rochester, N. Y.; died February 21; aged 89.

Howland, Frank H., Shrewsbury, Mass.; School of Dentistry, University of Pennsylvania, 1886; died March 3; aged 84.

Hrostoski, Julius, Queens Village, N. Y.; School of Dentistry, Georgetown University, 1931; died March 31; aged 42.

Huntington, Forrest W., Kansas City, Mo.; Kansas City-Western Dental College, 1929; died February 28; aged 56.

Hurst, Everett M., Eugenia, Ore.; died January 27; aged 63.

Hyams, Harry T., DeKalb, Texas; died February 11; aged 84.

Ivey, Francis H., Evanston, Ill.; College of Dentistry, University of Illinois, 1905; died March 24.

Jackson, Joseph B., Sr., Lubbock, Texas; College of Dentistry, University of Tennessee, 1916; died March 3.

Jefferson, A. W., Oakland, Calif.; School of Dentistry, College of Physicians and Surgeons of San Francisco, 1923; died February 27.

Johnson, Robert W., Duluth, Minn.; Dental School, Northwestern University, 1899; died April 9; aged 72.

Jones, I. E., Toledo, Ohio; College of Dentistry, Ohio State University, 1917; died April 7; aged 57.

Jordan, Louis E., Ottawa, Ill.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1901; died March 16; aged 74.

Jorgenson, George P., Grand Forks, N. D.; College of Dentistry, University of Minnesota, 1915; died March 31; aged 58.

Joyner, K. C., Nampa, Idaho; died January 31.

Kamerly, James C., East Northport, N. Y.; died January 29; aged 76.

Kantner, Charles A., St. Clair, Pa.; School of Dentistry, University of Pittsburgh, 1928; died February 16.

Kaufman, Harry, Newark, N. J.; died January 25.

Kepler, Harry C., Decatur, Ill.; died March 16; aged 74.

Ketcham, Edward T., Santa Maria, Calif.; died January 29; aged 81.

King, Gilbert V., Milwaukee; Dental School, Marquette University, 1928; died February 14; aged 52.

Kinzer, Walton R., Grinnell, Iowa; College of Dentistry, University of Iowa, 1915; died February 10.

Kirkland, Frederick G., Detroit; College of Dental Surgery, University of Michigan, 1910; died February 16; aged 63.

Kivney, Thomas K., Hartford, Conn.; died February 7.

Kranz, Walter, Denver; School of Dentistry, Vanderbilt University, 1903; died January 31.

Kumpitsch, Paul A., Hartford, Conn.; died February 18; aged 61.

Kupisz, William J., Philadelphia; died April 16; aged 42.

Lee, W. W., Athens, Ohio; Department of Dentistry, Starling-Ohio Medical College, 1911; died April 4; aged 62.

Leonard, Fred J., Piedmont, Calif.; died March 23; aged 46.

Lindow, A. R., Sheboygan Falls, Wis.; died March 5; aged 62.

Link, James A., New Smyrna Beach, Fla.; Southern Dental College, 1889; died March 8; aged 71.

Livermore, Alvie R., Smethport, Pa.; School of Dentistry, University of Pittsburgh, 1917; died January 26; aged 54.

Livingston, Bertel E., Chanute, Kan.; Marion-Sims Dental College, 1904; died February 4; aged 79.

Loughlin, Daniel M., Okauchee, Wis.; died January 29; aged 72.

Loveland, Frank A., Wrentham, Mass.; died March 24; aged 87.

Lucia, James E., Fond du Lac, Wis.; Department of Dental Surgery, Wisconsin College of Physicians and Surgeons, 1909; died February 7; aged 66.

Ludwig, Thomas L., Jacksonville, Fla.; died March 31.

Lunt, Wilbur T., Rochester, N. H.; Tufts College Dental School, 1905; died April 11; aged 69.

Lyman, C. W., Oklahoma City; College of Physicians and Surgeons, 1918; died February 9; aged 61.

MacPhail, James C., Boston; died April 6.

Mallery, Claude M., Scranton, Pa.; The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1904; died March 21; aged 65.

Marshall, William, Huntington Woods, Mich.; died February 4; aged 69.

Martin, Louis E., Philadelphia; Pennsylvania College of Dental Surgery, 1883; died February 23; aged 87.

Massey, W. A., Birmingham, Ala.; Birmingham Dental College, 1914; died March 4; aged 58.

Matthews, Harry W., Aurora, Ill.; Chicago College of Dental Surgery, 1912; died February 9; aged 56.

McCarton, Daniel J., Truman, Minn.; died April 7; aged 71.

McManus, Edwin A., Mesick, Mich.; died April 11; aged 85.

McMillan, James D., Macomb, Ill.; Chicago College of Dental Surgery, 1896; died March 14; aged 79.

Metzgar, Paul W., Reading, Pa.; School of Dentistry, University of Pennsylvania, 1922; died February 21; aged 52.

Mills, Thomas M., Wisconsin Rapids, Wis.; Chicago College of Dental Surgery, 1900; died May 3; aged 73.

Minghini, Willis E., Martinsburg, W. Va.; Baltimore College of Dental Surgery of the University of Maryland, 1893; died in March; aged 81.

Morg. Richard J., Rhinecliff, N. Y.; New York College of Dentistry, 1902; died March 4.

Morgan, William N., Columbus, Ohio; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1891; died March 7.

Morris, John R., Bellingham, Wash.; School of Dentistry, North Pacific College of Oregon, 1919; died March 1; aged 57.

Morrison, Peter H., St. Louis; Missouri Dental College, 1890; died April 21; aged 79.

Moskau, Gilbert, Grand Forks, N. D.; College of Dentistry, University of Minnesota, 1905; died March 23; aged 75.

Moyer, George W., Lansdale, Pa.; School of Dentistry, Temple University, 1923; died February 19; aged 53.

Murphy, E. R., Winchester, Mass.; Dental School, Harvard University, 1915; died March 12; aged 59.

Need, Warren E., Ellsworth, Kan.; Kansas City Dental College, 1913; died January 27.

Noble, Joseph H., Philadelphia; School of Dentistry, University of Pennsylvania, 1899; died April 2; aged 75.

Norton, Z. A., Milford, Neb.; Omaha Dental College, 1904; died February 12; aged 70.

O'Boyle, Thomas F., Scranton, Pa.; School of Dentistry, University of Pennsylvania, 1919; died in March.

Oddono, Raymond H., Washington, D. C.; died January 25; aged 28.

Ogur, Charles, Brooklyn; College of Dental and Oral Surgery, 1916; died April 8; aged 55.

Osborne, Grant W., New York; Philadelphia Dental College, 1899; died April 10; aged 76.

Ostrom, Bernard F., Avondale, Ky.; died April 2; aged 51.

Otterback, Morgan, Washington, D. C.; Baltimore College of Dental Surgery, 1901; died March 1; aged 69.

Outcault, B. W., Del Rey, Calif.; died in March; aged 84.

Ovary, Francis, New York; died March 14; aged 62.

Peyton, Robert K., Uniontown, Pa.; College of Dentistry, Howard University, 1921; died March 14; aged 52.

Porter, Charles B., San Francisco; College of Dentistry, University of California, 1896; died March 10; aged 80.

Rainhart, Bert I., San Diego, Calif.; died April 10; aged 45.

Rambo, B. F., Montesano, Wash.; School of Dentistry, North Pacific College of Oregon, 1906; died February 15; aged 70.

Rantz, William A., Placerville, Calif.; School of Dentistry, College of Physicians and Surgeons of San Francisco, 1902; died February 13; aged 70.

Reid, Thomas C., Blissfield, Mich.; College of Dental Surgery, University of Michigan, 1898; died February 26.

Reynolds, Herman E., Buffalo; School of Dentistry, University of Buffalo, 1899; died March 10; aged 75.

Rittner, Otto, New York; College of Dentistry, New York University, 1928; died April 6.

Roberts, Clell G., El Paso, Texas; died March 12; aged 50.

Rogers, A. R., Cornell, Wis.; died April 14.

Rogers, Harold W., Redmond, Ore.; School of Dentistry, North Pacific College of Oregon, 1923; died February 24; aged 49.

Root, George F., Philadelphia; Pennsylvania College of Dental Surgery, 1883; died March 5; aged 86.

Roper, A. Kent, New Haven, Conn.; School of Dentistry, Western Reserve University, 1913; died March 26.

Rush, Edgar D., Celina, Ohio; Ohio College of Dental Surgery, University of Cincinnati, 1905; died April 12; aged 70.

Rutledge, John E., Lancaster, S. C.; Baltimore College of Dental Surgery of the University of Maryland, 1890; died May 12; aged 86.

Ryan, Frank H., Chicopee Falls, Mass.; Tufts College Dental School, 1915; died March 10; aged 58.

Schell, Lee G., Seattle; School of Dentistry, North Pacific College of Oregon, 1907; died April 17; aged 65.

Schrantz, Samuel, St. Charles, Mo.; died April 2.

Schweichler, Louis H., Buffalo; School of Dentistry, University of Buffalo, 1932; died March 19; aged 41.

Shaver, Maitland V., Chicago; College of Dentistry, University of Illinois, 1909; died in March; aged 63.

Shaw, Zadoc P., Claremont, N. H.; Baltimore College of Dental Surgery, 1892; died March 28; aged 84.

Shell, Lee G., Seattle; died April 17; aged 70.

Siebert, Irwin J., Cleveland; School of Dentistry, Western Reserve University, 1916; died April 5; aged 58.

Smith, George W., Fremont, Ohio; died March 3; aged 84.

Smith, Harold B., Riverhead, N. Y.; Baltimore College of Dental Surgery of the University of Maryland, 1899; died March 16; aged 70.

Smith, John W., Jamestown, N. D.; Dental School, Northwestern University, 1919; died April 10.

Smith, Rae E., Portland, Ore.; School of Dentistry, North Pacific College of Oregon, 1922; died March 19.

Spence, Julian G., Houston, Texas; Atlanta Dental College, 1907; died March 17; aged 64.

Steinfeldt, A. A., Brainerd, Minn.; College of Dentistry, University of Minnesota, 1912; died March 21; aged 58.

Stephens, Clarence R., Chilhowee, Mo.; Western Dental College, 1908; died March 20.

Stevenson, Harlow R., Ogdensburg, N. Y.; School of Dentistry, University of Buffalo, 1902; died April 4; aged 70.

Stuck, Leon C., Chicago; Chicago College of Dental Surgery, 1915; died March 16.

Sullivan, William J., St. Helens, Ore.; School of Dentistry, North Pacific College of Oregon, 1926; died April 11; aged 52.

Sutton, R. H., Pocatello, Idaho; Chicago College of Dental Surgery, 1911; died March 16; aged 67.

Tait, J. Stuart, Jr., Philadelphia; Medico-Chirurgical College of Philadelphia, 1915; died March 7; aged 56.

Tantum, Horace, Nutley, N. J.; Philadelphia Dental College, 1910; died April 7; aged 64.

Taylor, James T., Flint, Mich.; died February 21.

Taylor, Roger W., Cincinnati; Ohio College of Dental Surgery, University of Cincinnati, 1899; died March 20; aged 73.

Taylor, Westford M., Newton Highlands, Mass.; Tufts College Dental School, 1895; died April 19; aged 83.

Thompson, Robert W., Huntington Park, Calif.; College of Dentistry, University of Southern California, 1938; died April 1; aged 33.

Tiedeman, E. H., Middleton, Wis.; Dental School, Marquette University, 1911; died April 10; aged 63.

Turk, A. B., Oklahoma City; Kansas City Dental College, 1919; died April 14; aged 64.

Vivian, Clifford W., New Britain, Conn.; School of Dentistry, Temple University, 1907; died March 19; aged 63.

Voelkler, L. H., Milton, Pa.; died April 2.

Wall, H. R., Bridgeport, Texas; State Dental College, 1907; died April 11.

Walsh, W. E., San Diego, Calif.; Philadelphia Dental College, 1900; died March 6; aged 62.

Warninger, Bruce, Yakima, Wash.; College of Dentistry, University of Southern California, 1946; died April 19; aged 25.

Watkins, Ralph E., Detroit; died January 5; aged 63.

Weis, John M., St. Louis; School of Dentistry, St. Louis University, 1908; died March 10; aged 78.

Westphal, Paul O., Norfolk, Mass.; died January 31.

White, W. Kingman, Savannah, Ga.; Baltimore College of Dental Surgery, 1912; died March 1.

Wilmot, Frederick G., New Haven, Conn.; died April 26; aged 88.

Wilson, James G., Cincinnati; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1905; died April 7; aged 79.

Wilson, Thomas S., Draper, N. C.; Baltimore College of Dental Surgery of the University of Maryland, 1919; died March 27; aged 53.

Wittenberg, Joseph J., Cincinnati; Ohio College of Dental Surgery, University of Cincinnati, 1924; died January 11.

Wright, George L., Syracuse, N. Y.; The New York College of Dentistry, 1893; died March 28; aged 81.

Zajkowski, Edward A., Maspeth, N. Y.; died March 22; aged 41.

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ANNOUNCEMENTS

MEETINGS OF STATE SOCIETIES

State	Date	Place	Secretary	Address
Alabama	May 1-3, 1950	Biloxi, Miss.	G. W. Matthews	1922 Tenth Ave., S., Birmingham 5
Arizona			H. G. DeWolf	Valley National Bank Bldg., Tucson
Arkansas			D. M. Hamm	White Bldg., Clarksville
California	April 24-26, 1950	San Francisco	L. R. Ludwigsen	450 Sutter St., San Francisco
S. California	April 3-5, 1950	Los Angeles	M. E. Ralston	Medico-Dental Bldg., Pomona
Colorado			R. A. Downs	724 Republic Bldg., Denver 2
Connecticut			E. S. Arnold	37 Linnard Rd., W. Hartford
Delaware			Norbert L. Gladnick	1009 Madison St., Wilmington
D. of Columbia			K. H. Wood	202-1835 Eye St., N. W., Washington
Florida	Nov. 10-12	Palm Beach	L. M. Schulstad	Professional Bldg., Bradenton
Georgia	Nov. 13-15	Savannah	J. M. Heard, Jr.	Persons Bldg., Macon
Hawaii			J. H. Dawe	P. O. Box 39, Honolulu 10
Idaho			H. R. Packard	Idaho Falls
Illinois			P. W. Clopper	623 Jefferson Bldg., Peoria 2
Indiana			E. E. Ewbank	Kingman
Iowa	May 1-3, 1950	Des Moines	H. I. Wilson	639 Insurance Exchange, Des Moines
Kansas			F. A. Richmond	1008 Huron Bldg., Kansas City
Kentucky	Mar. 29-31, 1950	Louisville	A. B. Coxwell	1976 Douglass Blvd., Louisville
Louisiana			J. S. Bernhard	407 Medical Arts Bldg., Shreveport
Maine			P. W. Anderson	32 Deering St., Portland 3
Maryland	May 1-3, 1950	Baltimore	E. L. Pessagno, Jr.	415 Medical Arts Bldg., Baltimore 1
Massachusetts			A. M. Bommer	349 Broadway, Revere
Michigan	April 24-26, 1950	Detroit	F. Wertheimer	Michigan Dept. of Health, Lansing
Minnesota	Feb. 20-22, 1950	St. Paul	C. V. E. Cassel	242 Lowry Medical Arts Bldg., St. Paul
Mississippi	June 11-14, 1950	Biloxi	F. C. Sneed	Osyka
Missouri	May 7-10, 1950	Kansas City	R. R. Rhoades	201 Merchants Bank Bldg., Jefferson City
Montana			C. S. Renouard	304 Phoenix Bldg., Butte
Nebraska			F. A. Pierson	Federal Securities Bldg., Lincoln
Nevada			L. G. Jacob	505 Chestnut St., Reno
New Hampshire			F. E. Williams	814 Elm St., Manchester
New Jersey	April 26-28, 1950	Atlantic City	J. G. Carr	407 Copper St., Camden
New Mexico			J. S. Eilar	First National Bank Bldg., Albuquerque
New York	June 5-8, 1950	New York	C. A. Wilkie	1 Hanson Place, Brooklyn
North Carolina			R. F. Hunt	Rose Drug Co., Bldg., Rocky Mount
North Dakota	May 7-10, 1950	Fargo	A. L. Smeby	Northwood
Ohio	Nov. 13-16	Columbus	E. G. Jones	185 E. State St., Columbus
Oklahoma	April 16-19, 1950	Tulsa	F. H. Binkley	Hennessey
Oregon			C. Fixott, Jr.	Medical Dental Bldg., Portland
Panama Canal Zone			R. O. Leon	Box 1094, Ancon
Pennsylvania			J. Wittek	217 State St., Harrisburg
Puerto Rico			F. Guerra	Avenida Ponce de Leon, Santurce
Rhode Island			J. F. Colgan	838 Newport Ave., Pawtucket
South Carolina			J. R. Owings	201 E. North St., Greenville
South Dakota	May 14-16, 1950	Huron	E. W. Elmen	Sioux Falls
Tennessee			E. J. Justis	Exchange Bldg., Memphis
Texas	April 23-27, 1950	Dallas	W. Ogle	313 Medical Arts Bldg., Dallas
Utah			H. R. Nordberg	807 Tribune-Telegram Bldg., Salt Lake City
Vermont			J. A. Larrow	Middlebury
Virginia	April 17-19, 1950	Roanoke	J. E. John	804 Medical Arts Bldg., Roanoke
Washington			F. J. Dingler	1502 Medical-Dental Bldg., Seattle 1
West Virginia			C. J. Gavelda	Union Bank Bldg., Clarksburg
Wisconsin	April 11-13, 1950	Milwaukee	R. A. Mason	964 N. 27th St., Milwaukee 2
Wyoming			T. A. Ward	Casper

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary	Address
Arizona	July 6-9	Florence	R. K. Trueblood	25 N. Second Ave., Glendale
California	July 25	San Francisco	K. I. Nesbitt	Room 307, 507 Polk Street, San Francisco 2
Florida	July 11-16*	Jacksonville	A. W. Kellner	P. O. Box 155, Hollywood
Maine	July 2-3	Augusta	R. A. Derbyshire	Box 387, Showhegan
New York	June 28-July 1	Buffalo	David W. Beier	23 S. Pearl St., Albany 7
	Sept. 30-Oct. 1	New York		
	Oct. 4-7	Buffalo		
North Dakota	July 10-14*	Fargo	W. J. Ford	Fargo
Rhode Island	Dec. 6-7	Providence	F. M. Hackett	State Office Bldg., Divn. Professional Regulation, Providence
South Carolina	July 25	Columbia	E. G. Bumgardner	1517 Hampton St., Columbia 1

*Dental and dental hygiene examination

OTHER MEETINGS

Name	Date	City	Secy. or Chmn.	Address
American Academy of Periodontology, Annual Meeting	Oct. 13-15	San Francisco	C. E. Chamberlain Secy.	115 North St., Peoria
American Association of Dental Examiners	Oct. 15-16	San Francisco	C. A. Bumstead Secy.	924 Stuart Bldg., Lincoln, Neb.
American College of Dentists	Oct. 16	San Francisco	O. W. Brandhorst Secy.	4952 Maryland Ave., St. Louis 8
American Dental Assistants Association Silver Anniversary	Oct. 17-20*	San Francisco	Mary L. Martin	610 Jefferson Ave., La Porte, Ind.
American Dental Association, Ninetieth Annual Meeting	Oct. 17-20	San Francisco	H. Hillenbrand Secy.	222 E. Superior St., Chicago 11
American Dental Hygienists' Association, Twenty-Sixth Annual Meeting	Oct. 17-21	San Francisco	A. Rebekah Fisk Secy.	1830 Eye St., N. W., Washington, D. C.
American Dental Society of Europe	Aug. 3-6	Paris	F. D. Derrick Secy.	140 Park Lane, London, W. 1
American Public Health Association, Seventy-Seventh Annual Meeting	Oct. 23	New York	R. M. Atwater Secy.	1790 Broadway New York 19
American Society of Oral Surgeons, Thirty-First Annual Meeting	Oct. 12-15	San Francisco	Harry Bear Secy.	1112 E. Clay St., Richmond 19
Federacao Odontologica Brasileiro, Fourth Congresso	July	Recife, Brazil	R. Ewerton	277 Avenida Rio Branco Rio de Janeiro
Greater New York Dental Meeting, Twenty-Fifth Anniversary	Dec. 5-9	New York	H. S. Horton Chm. Press & Publication	Rm. 106A, Hotel Statler, New York 1
Maryland State Dental Association, Semi-Annual Meeting	Sept. 25-27	Hagerstown	E. L. Pessagno, Jr. Secy.	Medical Arts Bldg., Baltimore 1
Midcontinent Dental Congress, Ninth Annual Meeting	Nov. 27-30	St. Louis	J. E. Brophy Secy.	Syndicate Trust Bldg., St. Louis
National Board of Dental Examiners	Dec. 5-6†		G. L. Teall Secy.	Box 71, Hiawatha, Kan.
New England Dental Society, Annual Meeting	Oct. 5-6	Boston	A. R. Wilson Secy.	43 Farmington Ave., Hartford
Ohio College of Dental Surgery, Thirtieth Anniversary Reunion, Class of 1919	July 3-4	Cincinnati	F. W. Long Pub. Chmn.	First National Bank Bldg., Norwood 12

*Examination for certification
†Examinations (Part 1 and Part 2) will be held in schools where there are five or more candidates